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PUBLISHERS' ANNOUNCEMENT.

Hereafter the JOURNAL will be published on each Monday of the year. Copy cannot be received later than each Thursday—that is, to insure its appearance in the issue following its reception. Advertisements must be handed in by Friday morning. It is not the intention of the publishers to make any advance in either subscription price or advertising rates.

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OUR PAST AND OUR FUTURE.

Even our most captiously disposed readers must admit that we do not incline them toward criticism because of what is put forward in our columns in the shape of mention of our own greatness, or of how far we can and do excel others; nor do we propose now to deviate from a principle or to alter a practice—the worth of which was proven long ago—that has stood us so well. Yet, while admitting that silence is golden, the admission must also be made that speech is silver; and for the time, then, our readers shall have to put up with a trifling jingle of the baser metal.

To begin with, about 30 years ago (to be precise, on the 1st day of July, 1859), the first issue of this JOURNAL appeared, and while it may have been a ponderous enough tome in those early days, or at the time when American technical journalism was emerging from the state of tender infancy, we are compelled to concede that that original sheet is now pointed at as a sort of curiosity; and not with any degree of reverence, either. But the progress of gas lighting—although an art or industry that had been known and pursued, even then, for something over half a century in the old world and for over a third of a century in the new—was slow. Probably the 12 years immediately preceding the birth of the JOURNAL were those in which the gas business of this country received its greatest impetus, and to the far-seeing residents of Philadelphia and its immediate vicinity must be awarded the credit of divining the great future in store for an industry, which was looked upon with awe by some and with distrust by many.

It is needless to prolong this narative in lines which we said were to refer to ourselves. The wonderful development in the gas business in the interim of 1858 and 1888 is known to all; and it is not an exaggeration to illustrate this growth by asserting that more gas was sold on the eve of last Christmas than was disposed of in either half of the year 1858. This dip into what the liberals love to term ancient history was made solely for the purpose of showing that as the gas man advanced so also did the JOURNAL. And mentioning this pet liberal sling at ancient history leads us to remark that they who fume most violently at this sort of history are either those whose records are not over long, or else are not consecutive. Missing links may and undoubtedly do conduce to mystery; but mystery and mysteries are most unsatisfactory.

Perhaps that sort of journalism which aims to teach may be antiquated, and if so we plead guilty; for that is the direction in which our efforts are put forth—we have neither desire nor intention to dispute the supremacy of the daily newspaper, although we may try to, as far as we may, correct and offset the nonsense that the latter often puts forth

as gospel when dealing with the craft or policy of the gas maker. No; we wish to give technical assistance to the brotherhood; and that assistance is offered according to our best light. And as it is with our technical columns, so also is it with whatever editorial opinion we advance. We have neither favorites to assist nor foes to hinder. What we desire is the advancement of the profession on safe lines of march, and the taking of no step which is not reasonably safe. Progress is all very well; but he who in taking four ill-considered swift steps, with the result that he is obliged to retrace two of them in order to pick up the trail, in the end is not so close to the looked for goal as the steady plodder who, in picking out each step, made reasonably certain of where each footfall would land him.

We therefore feel safe in asserting that no mistake has been made by the publishers in the course which they have decided to pursue in regard to the conduct of the JOURNAL, and which they concisely state on the first page of their weekly issue. We are not unmindful of the task which is before us, but approach it with a feeling of confidence that the legion of friends who have granted us their material aid and moral support in the past shall help us on with like assistance in the future. In return we shall give them full value, and we presume it is unnecessary to add that as our prosperity increases so shall that prosperity be reflected in our columns. Our branch of technical journalism covers no royal road to fortune, although we have to say that the most prosperous year in our history is that which has just closed. Extending our warmest thanks to our fellow-craftsmen for that support which rendered this statement possible, we are confident that our weekly issue will not only be welcomed by the old guard, but will also be hailed by the new.

A NEW PRESIDENT ELECTED.

It is with much pleasure we announce the fact that at a meeting of the Directors of the Worcester Gas Company, held on the 27th inst., Mr. Chas. D. Lamson was elected to the position of President of that Company. Mr. Lamson has been connected with the Boston Gas Company for a long time, in fact, we believe ever since he graduated from the Scientific School at Cambridge, some 20 years or more ago. He has proved a valuable and efficient person to the last named corporation, and had the supervision of the new plant of the Boston Company at Commercial Point, of which works since their completion he has remained the General Manager. He will begin his work at Worcester immediately, going there as often as possible until he gets his business arrangements fully settled with the Boston Company, and thereafter taking up his residence at Worcester. Mr. Lamson in his new position will have full and absolute control in all matters relative to the business and plant, and Mr. Wetherbee will act as Superintendent of the works. We can congratulate the Directors of the Worcester Company upon the selection they have made, as we believe they will find Mr. Lamson to be the right man to fill the position acceptably in every sense.

An Important Decision.

The following is from the Cincinnati *Commercial Gazette* of December 25:

An important decision as to the rights of the Gas Company in dealing with customers who do not rely upon gas for illumination, but make a convenience only of their gas connections, was rendered yesterday by Judge Shroder in the Common Pleas Court. The decision in full is as follows:

"On May 24, 1888, an order was issued in this action restraining defendant from severing the gas connection between its gas main and the plaintiff's Baker street premises; also from refusing to furnish gas for lighting said premises. Defendant's motion to vacate this order is submitted upon affidavits, city ordinances and other exhibits.

"It appears from the evidence that upon plaintiff's application in 1877 and 1883 the defendant made connections and furnished adequate meters to supply gas for 100 burners in one room on the north side of Baker street, and 60 burners in another room on the south side of Baker street. Until November, 1887, the average annual consumption of gas supplied through these meters was respectively 12,500 and 158,700 feet. From November 1, 1887, to December 1, 1888, the consumption in one room was 2,100 feet, and in the other 1,200 feet; that this use of the gas was in one room during the months of July, September and November, and in the other during the months of April, September and October. The meters cost the defendant $40; the expense of keeping them in good order was annually $4; the revenue from the plaintiff from November, 1887, to December, 1888, aggregated $3.80. The non-use of meters causes their deterieration and otherwise injures them.

"The Express Company denies that it has ceased to use gas, and affirms its intention to continue its use; and as late as June 30, 1888, (the date of the jurat to the reply submitted as an affidavit), it expressed the expectation of using it 'each and every month.' The evidence, however, discloses that its use of it was limited in each room, not to any one period of three succeeding months, but to three separated months, scattered through the entire year. The plaintiff avers that the denial of gas will greatly embarrass it in its business, and especially in the event of accident to its electric light system.

"By virtue of its charter and the statutes, and with the consent of the City Council, the defendant is endowed with the right of laying its pipes in the streets of Cincinnati. This franchise is granted by the State, and is accepted by the Gas Company, for reciprocal purposes; that is, to enable the company to sell and deliver its gas, and to enable the inhabitants of the city to obtain it. The right and obligation of the company and of the consumers are mutual in view of the peculiar nature of the business of manufacturing and selling gas, and of gas as a commodity. In the latter respect it is an article essentially of local production and of local consumption. The manufacturer can not carry it, like any article of commerce, to any other market than the locality of its production; nor can the consumer obtain it in any other place. The business is one which requires associated capital and labor in its conduct. Its public character subjects it to the demands of public convenience and necessities, and entitles it to conduct its operations under, and to require public compliance with, just and reasonable rules and regulations of its own adoption. As between the State granting and the defendant accepting the franchise, considering the subject of the grant, the object to be accomplished, the reciprocal advantages which are sought to be secured, it must be taken that the right and privilege of laying pipes in the streets and other franchises are granted in consideration of the consumer's right to obtain gas from the company for his own uses. The company's rights thus create this corresponding duty and obligation. [Williams vs. Mutual Gas Company, 52 Mich., 499.] The Rev. Statutes, Sec. 2482, in part enforces this obligation by enacting the penalty of forfeiture of its charter for any neglect to furnish gas. The provisions of the statutes, however, indicate that the duty is not intended to be without just limitation.

"Section 2478, R. S., empowers Council from time to time to regulate the price which the company shall have the right to charge consumers. This makes it compulsory upon it to supply gas at such price. In this case Council has by ordinance, passed February 13, 1880, and February 27, 1887, fixed the maximum price. The statutes do not intend that this power vested in Council is to be exerted either arbitrarily or capriciously, [State vs. Cincinnati Gas-light and Coke Co., 18 O. S., 263-301,] but they contemplate its being exercised fairly and with discretion, having in sight the just requirements of both the consumers and the company, taking into consideration, among other things, such prospective use of gas for an illuminant as could be reasonably anticipated.

"If it be reasonable to regard the statutes as evidencing this purpose and intention, then they indicate a limitation to the company's duty of supplying gas to consumers. It would exclude such uses as are exceptional or accidental, or as may be made necessary by reason of extraordinary emergencies. This view of the law would not authorize the company to decide for any consumer the quantity of gas he is to use, nor to refuse him a supply because it entails a loss upon it. Whether or no the consumption is exceptional or accidental or for an extraordinary emergency only, would require the taking into consideration the habits, disposition and necessities of the individual consumer and the special circumstances of each case. If the company would not in such case be obliged to supply gas, it follows that it would not, under like conditions, be bound to continue its gas connections for such purposes.

"The evidence discloses that since November, 1887, the plaintiff's use of gas was exceptional; that it did not expect to consume it in the Baker street rooms unless on such occasion as when the failure of their electric light would embarrass its business. If the introduction of the electric light has rendered the gas so unserviceable to plaintiff as to confine its use, in very limited quantities, to occasions exceptional in their nature, or when accidentally or temporarily deprived of its electric light, then it must be held to have ceased being a consumer of gas as contemplated by the statutes. Under such circumstances there is no duty upon the defendant either to supply gas or to continue its gas connections with the said Baker street premises. The conclusion is that the motion to vacate the restraining order ought to be granted as to said premises. It is so ordered."

[SECOND ARTICLE.]

A Review of Patents Invented and Inventions Patented in the Gas Interest the Past Year.

By FREDERIC EGNER.

Carbonizing coal by other means than the heat obtained from fire has been described by several parties. Abraham Solomons and Azulay Bondy were granted a British patent (May, 1848) for carbonizing coal by means of highly-heated steam. Wm. Benson Stones patented in England (1850) a process for using "superheated steam in lieu of fire for carbonizing shale, cannel coal, or bituminous substances;" and Edward Lavender (in 1857) again patented the same thing—viz., "distilling or carbonizing coal by means of highly-heated steam." This inventor is careful to direct that his distilling apparatus must be lined on the outside with a non-conducting substance, and that no fire is to be used except for raising the steam.

In view of these examples, the invention of G. M. Westman, to distill coal, *by means of highly-heated gas*, seems not to be unreasonable. This inventor claims to be able to produce more and better gas with far less labor and fuel from any given quantity of gas coal than has heretofore been possible by means of our well-known clumsy, unscientific retort house work. The process was patented November 20, '88, and the number of the patent is 393,134. As the patent was issued since the first pages of this paper were written, it was not included in the previously published list of patents. We may return to the subject of this patent later on. In 1854 John and Theo. Nesham Kirkman patented in England an apparatus and process to make gas, in the specification of which is described an air-tight furnace with a steam boiler over it. Air is blown by force into the furnace, and the products of combustion carried through the flues of the boiler to aid in making steam. When the coal in the furnace is in an incandescent state steam is introduced (which may be previously superheated), producing gas, which the inventors state "can then be carbureted." The description of the process reads very much like that of some of our latter-day "improved water gas processes." In 1845 John Constable patented a process for making gas from *anthracite* coal and steam, which he afterwards carbureted with turpentine vapors. Cheap gas naphtha was not to be had at that time. Wm. Vere and Henry Samuel Crane made gas, in the year 1823, in an apparatus the description of which would not fit badly the "Allen and Harris" style of water gas apparatus with which we are more or less familiar, and which is a very good process in its way. Uriah Haddock describes liming coal and the results to be expected as we know them now as early as May 4, 1849. Alex. Angus Croll and Wm. Richards made gas by decomposing water by means of zinc and sulphuric acid, and then carbureting the hydrogen with light oils. It remained for the American inventor of that patent to add the oyster shells to make the process complete, as described in the columns of this JOURNAL, issue for October 2, 1886, p. 194.

Decomposing water by electricity is likewise now "Ancient History," although somebody re-discovers the same thing every once in a while, and with commendable promptitude patents it. Geo. Lowe (1831) describes what would now be called a regular water gas process and apparatus very much like that of our Professor T. S. C. Low, to whose indefatigable perseverance and indomitable pluck, in the face of seemingly insurmountable opposition and obstacles, we owe, perhaps, more than to anyone else the present system of water gas processes; for water gas has come to be accepted, either as principal, or at least as auxiliary, by some of the most orthodox of coal gas men of other days, as we all know. Making gas from oil, fatty matter, water and air, like the "Chamberlain Process" (described Aug. 17, 1885, in this JOURNAL), has been patented so many times that the writer fails to remember them all.

It would fill several volumes of this JOURNAL to give even an abstract description of all the methods and apparatus proposed and patented for making gas twenty and more years ago, and were we to keep on citing precedents we would scarcely get to our review of last year's patents before another year's crop would be upon us. But the examples named are perhaps sufficient to convince the reader that it is indeed difficult to devise something really new in the line of gas making. The Revised Statutes of the United States (1878–1886) provide that "a patent may be obtained by any person who has invented any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement thereof, not known or used by others in this country, *and not patented or described in any printed publication in this or any foreign country* before his invention or discovery thereof, and not in public use, or on sale for more than two years prior to his application, etc." It can be seen from this quotation of the laws governing the issuing of patents that the official examiners and their assistants of the U. S. Patent Office must be well-read people and specialists in their respective branches; and, fortunately, they are all that can be expected, as anyone who ever had dealings with the Patent Office soon found out. It is the best evidence in favor of these worthy—and sometimes abused—government employes that, in face of the fact that so many things have been invented, patented, forgotten and re-invented over and over again, and of the immense amount of printed matter to be gone through with of this and foreign countries before a claim can be passed upon, that not more old-time inventions do pass than those we see.

And now let us look at the patents of the past year a little closer, and try to arrive at an idea of their practical value to gas men. As the writer's opinion on the subject may not in every case do justice to the inventions—although this would be because of ignorance rather than intention—the titles, dates, subjects and number of the patents were given, so that anyone desirous of pursuing further the object presented could easily do so. The carburetor patents we can dismiss without comment, except to say that there are over 400 U. S. patents for carburetors in existence to date, and that although some of them are very ingeniously arranged, all amount to about the same thing. There is a remarkable similarity between quite a number of them, causing one to have the, of course, erroneous thought that perhaps the Patent Office granted the patent just to make the applicant happy in the possession of one of their handsome lithographs—as the subject could not do any harm anyway; also, to save much unnecessary explanation and some hard feeling.

The carbureting lamps are all very nice arrangements, and are all trying to do what the well-known albo-carbon lamp does, and does well, as you all know. The gas traps or drip-boxes are both good arrangements. The idea on which they are built is the float and lever order sometimes used in closets. The object is to allow the drip water to flow away into some adjacent sewer, and thus save the labor of pumping the drips; and, what is more important, viz., to make sure that the drips are kept clear when they ought to be. One objection to these self-acting drips is that most city authorities will not permit the drip water to be thrown into the sewers.

We have a gas main patent. It is an ordinary main, with the addition of having circular projections at the ends of the pieces, reducing the diameter of the pipe at those points. The inventor claims that with such a main he can pass more gas than with one of full size and without said obstructions, as, he says, there is less friction. Means for clearing gas service pipes consist of a long-handled screw-shaped augur—that is all, so far as the writer could see. "Means for carrying off escaping gas," consist of a gas-tight jacket placed around each pipe joint, and from this jacket another pipe is to carry off the possible gas, lost by leaking out of the original joint, to the atmosphere or elsewhere. To detect leaks in gas mains we have another bright device somewhat like the preceding one. Tight jackets are placed around the pipe joints, and pipes are run from these jackets to pressure gauges. If a joint gets leaking, all you have to do is to look at that particular pressure gauge and you will know just where it is, see? A new system of gas distribution consists of a combination main.—a high-pressure main within a low pressure gas main, the two connected at two or more points with suitable pressure regulators. It would seem to the writer that if gas was to be conducted under high pressure a pressure regulator at each service connection would be cheaper and better than the above system of a double main; but it would not be a patent. The retort charging machine presented consists of a long curved tube—carried on suitable carriages in front of the benches, and one end on a high frame. The charge of coal is dumped into the top of this chute, and is supposed to rush into the retort and distribute itself as desired. The retort door patented may be different, but it looks very much like one patented by the late I. Herzog, Engineer of the then Metropolitan works of New York, and Mr. Richard Koch, and used successfully many years. It is, of course, on the self-sealing order. The hydraulic main invented and patented by those well-known gas engineers, Messrs. Geo. A. McIlhenny, the Engineer and President, and T. G. Lansden, Supt. of the Washington (D. C.) Gas Light Company, is an article such as might be expected from those gentlemen. It is a hydraulic main combined with a bye-pass to the seal, which is simple, effective, and cannot fail to work. It is easy of access for cleaning purposes, and, in short, seems to possess all those desirable features in a hydraulic main which one can perhaps describe best by saying that "it completely fills the bill."

(To be continued.)

THE electric light works at Chico, Cal., were totally destroyed by fire, December 17th. Loss, $30,000; insurance, $9,000. It is suspected that the fire was of incendiary origin.

Notes and Comments.

By OBSERVER.

So much has been said on the subject of electric lighting and the relation it bears to gas lighting that it seems well nigh impossible to submit anything new in this regard; but as truth loses nothing with age, I will venture a few statements, trusting that someone may be benefited thereby.

When the electric light was first brought to our notice we were told that our day was over, and that, like Othello, our occupation would soon be gone. Gas Companies, however, have good staying qualities, and, like the poor, they are still with us. I well remember a remark of Mr. R. P. Spice, of London, England, uttered some years ago, to the effect that there would be more gas sold than ever before; and in saying this he but voiced the sentiments of many others of the profession. Some time after the promulgation of Mr. Spice's prophecy, a correspondent of the JOURNAL came out boldly and said: "The electric light has come to stay—and so has dollar gas!" Here was a splendid rejoinder to the boast of the electric light promoters; and he was right, as subsequent events have proved. Let us look into it.

For years past the price of gas has steadily declined, and now we have many companies selling at $1.50, $1.25, and $1; and I think that before the close of this century more gas will be sold in the United States at $1 per thousand cubic feet than will be the combined sales of this product at all rates over the dollar mark.

The arc light, for inside lighting, has had its day; the public have borne with its shortcomings long enough; and they certainly have been very patient. In the course of my wanderings, when, during a resting spell, seated comfortably in a hotel parlor or reception room, I have been afforded ample opportunity of witnessing its vagaries and appreciating its incompleteness as an illuminator—its spluttering, hissing, and fluctuating fantasies make it most trying to the human eye and discomforting to the human nerves. Indeed, I have wondered how people could stand it all; but they did. And, what is more, they apologized for it.

In a small Indiana town I recently had occasion to note that the local arc lighting system failed four times within an hour; and this caused me to speculate on the length of time the people of the place—the ordinary gas consumers of the town—would stand such a state of affairs were gas the offender. Still, indoor arc lighting was, at one time, a new thing, and being new some people thought it ought to be encouraged. The "newness" made some difference; but the sheen having worn off, the arc light is being relegated to the street—the place where it belongs.

Now comes the incandescent electric light, paying a worthy tribute to gas in the instance of color, glow, and pleasantness to the eye. This light can be and is being run into every room in a building, from cellar to garret, as the saying goes, somewhat after the fashion of gas supply; thus (in the sense of installation, at any rate) competing with the latter. It can be turned on and off like the gas jet, it throws off little or no heat, it does not vitiate the air of the room, and it is safe to handle. So we see it has its good qualities. But let us analyze some of them. As far as absence of heat is concerned, I believe that this is not all gain. In fact, I think that the heat given off by a gas flame is a positive benefit during 8 months of the year, and that in the remaining 4 months our rooms are so freely ventilated, through the lavish admission of pure air, that the asserted contaminating effect is assertion pure and simple. And in any event, I believe that our rooms should be properly ventilated, irrespective of the nature or order of the artificial lighting agent employed.

That the electric lighting promoters have pushed their wares for at least all there is in them, cannot be denied—some even are outspoken in the belief that the "pushing" is to a greater extent based on claim than on fact—and that they are still pushing them.

The electric light promoter and the supply man are abroad. No doubt about this whatever. They are asking capital to interest itself; nor are they asking in vain. Money is cheaper than it was a decade ago, and is eager to seek repose in a reasonable interest return. Further, a gas company is looked upon as a rank monopoly that reaps great profit out of its dealings with the poor consumer. Then, the incandescent lamp is a novel light, and the people of a small town, having heard that a neighboring town is using the new system, say we must follow suit or be behind the times; and so it goes.

The question with gas companies to-day is, "What shall we do about it? Shall we control the lighting of this city, or shall we go on as we are, making good and cheap gas, and let the electric light alone?" Opinion is divided on the answer, and I suppose that each must decide as to the proper course in its own locality; for it seems reasonable to hold that each can best estimate the nature of his surroundings. Speaking for myself, however, I say most unqualifiedly that I have small faith in the future of this so-called "light of the future"—that is, as a successful competitor of gas, in the matter of relative cost. Of course, I must hold to this unless some great improvements are developed; say, for instance, the discovery of some new principle in the generation of steam, whereby greater power can be obtained from the combustion of a pound of coal. Yet to offset this saving clause to my opinion, it is at least just as reasonable to suppose that some great improvement may be brought about in the manufacture, distribution, or consumption (or in all three departments) of gas. We know that much has been done in this line in the past, and we reasonably look for a still greater relative advance in the future.

I would here like to quote a few lines from *Fibre and Fabric* on this subject. These are: "The facts briefly stated for the practical man are as follows: Common illuminating gas, well made, yields up only about 14 per cent. of its efficiency in light. Very much loss is made in the rendition of heat after it has been made, scrubbed, and delivered into the pipes, ready for the burner. On the other hand, the perfection of the dynamo, mechanically and electrically, readily yields from 86 to (in some exceptional cases) 91 per cent. of the outlay in power by destruction of the coal or gas, or whatever is used to make the heat by which the steam engine transmits the coal or gas into dynamic electricity."

These words suggest to my mind this query: "If we are only getting now about 14 per cent. of the value of our gas, and hence are losing 86 per cent. of the real value, how shall we stand when we capture the 86 per cent. and lose only the 14 per cent.?"

Shall we not have made great strides toward that point which Mr. James R. Smedberg told us of recently—viz., "128,000 candles to the foot?"

(To be continued.)

A Comparison between Oil and Gas.

The London *Journal*, in a recent issue, makes the following interesting comments:

The necessity that exists for a better knowledge as to the capabilities of coal gas amongst consumers of the same was markedly illustrated by the lecture delivered at Holly Park, by Mr. Defries, an inventor and manufacturer of oil lamps. The best reply that the gas company supplying the district could make to the remarkable line of argument followed by this gentleman in his endeavors, not only to make out the best possible case for his special manufactures, but also the worst for gas, would be to fit up a few dining rooms and drawing rooms in the district with gas burners of the most approved modern kind, and thus practically illustrate the fact that gas is capable of yielding four or five times the duty that Mr. Defries credits it with. It is only natural that this gentleman should be very strongly prejudiced in favor of oil, and, of course, he is perfectly at liberty to state his opinions; but when he condescends to endeavor to prejudice coal gas by the adoption of a disingenuous and unjust line of argument, it is necessary to point out the fallacy of the same. Passing by the popular clap-trap to the effect that gas has got to the top of the tree as an illuminating agent (which is perfectly true, although not in the sense intended by this advocate of oil), has passed the zenith, and is going down hill, we come to the means by which he arrives to his own satisfaction at the conclusion that oil—burnt in a Defries lamp, of course—is only one-fifth the cost of gas. Or, in other words, that "when burnt in the best mineral oil lamp known, and the one in most general use"—that is, the Defries—it affords a given light at one-fifth the cost of a similar light from gas. The standard of comparison adopted in the lecture is a light of 43 candles for 5 hours, which it is alleged can be obtained by the consumption of one pint of oil. With oil at, say, 8d. per gallon, the cost of this would be 1d., for which a lighting effect of 215 candle-hours is claimed. The subject of gas lighting is approached with great caution, which may be due to ignorance. A Bray's No. 6 fishtail burner is said to generally use 7 or 8 cubic feet per hour, but is taken as using 6 cubic feet, and yielding a light equivalent to 15 candles. Three such burners would be necessary to yield a light of 45 candles. These are alleged to consume in 5 hours 90 cubic feet of gas, which, with gas at 4s. 6d. per 1,000 cubic feet, would cost 4$\frac{1}{2}$$\frac{3}{6}$d., or say, 5d.

We would first point out two or three obvious defects in this argument, all of which tell against gas and in favor of oil. There is nothing estimated for the cost of a wick, or the extra trouble in cleaning, trimming, replenishing, etc., required with the oil lamp. Then, whereas a duty of 215 candles is required for the oil, 225 candles is the duty obtained from the gas with which it is compared, or an excess of nearly 5

per cent. Then there is another instance of petty inching on, where a cost of 4¼d. is said to be practically 5d. These little matters alone, which certainly would not be overlooked by anyone desirous of making a fair and just comparison between oil and gas, would reduce the estimated cost to nearer 4d. than 5d.

In the course of a paper read before the Society of Chemical Industry, on "The Present Position and Prospects of the Coal Gas Industry," by Mr. Lewis T. Wright, in May last, the following comparison between the cost of oil and gas lighting was given, the standard being 1,000 candle-hours:

Best result obtained with mineral oil at 8d. per gallon after trying various forms of lamps	5.63d.
Gas at 2s. 3d., Schulke burner	2.70d.
" " Wenham burner	3.90d.
" " Ordinary flat-flame burner	7.70d.

Compared with this standard, Mr. Defries' results work out to:

Mineral oil at 8d	4.6d.
Gas at 4s. 6d	23.0d.

The means adopted in order to arrive at this result are patent to everyone. Mr. Defries takes for the basis of the oil calculation a careful laboratory experiment with his own lamp, which for the present purpose may be accepted as what it is said by its inventor to be, "the best mineral oil lamp known." But for gas he takes the ordinary burners as used by consumers, which are known to be incapable of developing anything like the best possible lighting effect from the gas. This course is popular with the makers of electric lamps, and enables them to prove (!) to their own satisfaction that electricity is cheaper than gas, in spite of the known fact that in practice it is found to be equivalent to gas at about 7s. 6d. per 1,000 cubic feet. If a fair, honest comparison was desired, both would be put upon the same footing. Either the gas would be burnt in the best known gas burner, in which case it would yield some four times the duty credited to it by Mr. Defries; or else ordinary oil lamps that have been some time in common use would be used for the oil. When the Defries lamp, using oil at 8d. per gallon, is compared with the best gas burners, it will be seen that it is about on a par in regard to cost with ordinary gas at 4s. 6d. per 1,000 cubic feet, and this without making any allowance for the extra trouble and attention which, it will hardly be disputed, is necessary in the case of oil. So much for the claims as to the economy of oil. It can be as readily shown that the claims for its superiority are equally as disingenuous, specious, and illusory in their nature.

It was stated that a much steadier light could be obtained from oil than from gas; and the manner in which this point was set forth would lead the listener to believe that owing to some inherent defect it was impossible to obtain a perfectly steady light by means of gas. The real facts of the matter are that a flame, whatever its source—whether gas, oil or candle—will be steady or otherwise according as it is exposed or protected from draughts of air. Expose an oil flame to the same circumstances as those which obtain in the case of a naked fishtail gas burner, and it will flicker and smoke to a much greater extent; the oil flame being much more sensitive to atmospheric influences than the gas. Protect the gas flame by means of suitable shades, etc., and the light will be perfectly steady. It is almost superfluous to state that if a perfectly steady gas flame is required, any respectable gasfitter who understands his business would know how to meet the requirement.

The statement that no form of gas burner has yet been constructed that will perfectly consume all the carbon or sulphur in gas is simply untrue. Can Mr. Defries or anyone else prove the production of unconsumed sulphur from coal gas? This, however, is a matter of no moment, seeing that the quantity of sulphur present is infinitesimal, about one part in 3,000, and therefore of no more consequence than the striking of a match tipped with sulphur. As to the escape of unconsumed carbon, this may occur if the flame is left exposed to draught or is otherwise improperly treated. Under proper conditions of use a gas flame is, if anything, much less likely to give off soot or smoke than an oil lamp. It is quite true that flowers will not flourish in small rooms where ordinary gas burners are used; but we have yet to learn that, where modern improved burners are employed, the same effects are noticeable. In any case it is more a case of ventilation than of the use of gas. Mr. Defries conjures up an appalling vision of a grand sum total of headaches, dyspepsia, and other human miseries, which he hardily asserts are due to the use of coal gas as an illuminant; but on this point, however, proof is wanting. As compared with gas, he claims that oil will not vitiate the air to any appreciable extent. But let us examine the facts. Oil, like gas, consists of carbon and hydrogen, and goes to form water vapor and carbonic acid in the act of combustion. Assuming proper precautions are observed in selecting suitable apparatus, the conversion into these substances will be practically complete. At any rate we know it is so in the case of coal gas, having seen chimneys of regenerator burners that have been in use for weeks without the slightest particle of carbon or dust in them. Taking the pint of oil above alluded to, the weight will be about 1¼ pounds. Since hydrogen is so light, it only represents a small percentage by weight, and therefore the bulk of this consists of carbon, so it is evident that the pint of oil when burnt will evolve about 3 pounds, or some 25 cubic feet of carbonic acid, whereas 90 cubic feet of gas will weigh something under 3 pounds, of which about three-fourths will consist of carbon, giving a result of rather more than 6 pounds of carbonic acid. Even with Mr. Defries' excessive estimate the vitiating effect of coal gas will only be about double that of oil; but if the consumer, desiring to have as pure an atmosphere as possible, elects to take advantage of modern improvements, he can have the same amount of light as we have seen, with an expenditure of one-fourth the quantity of gas. By so doing he reduces to a corresponding extent the vitiating effect on the atmosphere of the room in which the light is used, or to about one-half of that obtaining in the case of oil, thus proving a claim that has repeatedly been advanced on behalf of gas, and never been refuted—viz., that, light for light, gas vitiates the air to a less extent than any other illuminant.

Weight for weight, it is evident that oil will require a smaller quantity of oxygen than gas for complete combustion, because it contains less hydrogen; and that whereas with the oil carbonic acid is the principal product, there will with gas be also a considerable proportion of water vapor. Approximately it may be said that oil requires twice its weight, and gas three times its weight of oxygen for complete combustion. Oil gives off about three times its weight of carbonic acid, and gas about twice its weight; the remainder of the oxygen coming off as harmless water vapor. This is sufficient to show that any prejudices as to the use of oil allowing a pure atmosphere to obtain, while the use of gas under precisely similar circumstances would render it impure and unwholesome, have no foundation in fact. The public have now used gas for half a century or more, and if the poisonous properties so eloquently dilated upon by Mr. Defries had any real existence, they would long ago have found them out and discarded that means of illumination in consequence. Whether they use gas, oil, or electricity, there is need for improving the ventilation of ordinary domestic apartments, and this is the direction in which to look for improved health, etc., rather than in the substitution of one illuminant for another.

Electric Lighting in America.

[In response to several inquiries we herewith reproduce the lecture on this subject, delivered by Prof. George Forbes, F.R.S., at the last meeting of the British Association for the Advancement of Science.]

Having since the last meeting of the British Association had occasion to pay two visits to the United States, and while there to study very carefully the systems of central station lighting in vogue, and also to compare what was being done there with what was being done here, and being, further, able to compare the state of central station lighting in America as it is at present with the condition it was in four years ago, when this Association visited America, I felt it was a sort of duty I owed to the Association to bring before it some account of what I had seen, believing it would be especially interesting at the present moment, when there are signs of a very great determination on the part of the public in this country to have electric light supplied to them from central stations. At the same time I felt considerable diffidence in bringing before you the facts which have been collected—not in the least because there is any want of facts, but by reason of their number, which renders it difficult to make a proper selection of the points likely to be of interest to the members of this section.

In the first place, it has been often stated, and one cannot help commencing remarks of this kind by repeating that enormous progress has been made in central station lighting in America. At the moment one lands, one is struck by it; and when one lands, upon returning to England, one is equally struck by the dimness of the lighting in our streets. In America there is not a single town with which I am acquainted where you can walk in the streets at night without seeing very many arc lamps. I am not simply speaking of influential towns like New York, Philadelphia, and Boston, but of the most out-of-the-way places in the most distant States where gas has never penetrated. There electric lighting has fixed its position, and it is being used frequently. Not only has the electric light been adopted in these remote towns, but other developments of

electricity have followed. As an illustration of the kind of places to which electricity and electric lights have found their way, I may mention that I have a paper here published in a village in Alaska, one of the least developed of the territories of the United States, and the same number of this paper, which treats of the introduction of electricity in a scientific manner, treats also of the advisability of passing a law for the expulsion of Indians from the city at 9 o'clock every evening.

At the time I was attending the Electric Light Convention at Pittsburgh last February it was estimated that there were then 300,000 arc lamps lighted from central stations in America. The progress of arc lighting of late years, however, has not been so striking to an Englishman as formerly; the arc light was firmly established when the British Association visited America four years ago. The progress which has struck us all latterly has been the progress in incandescent lighting. At the same time—I am speaking of February of the present year—it was estimated that there were 2½ millions of incandescent lamps in use in the United States, and the rate of manufacture has increased enormously to my knowledge since that short time ago. There are four or five manufacturing places in the United States at this moment, each capable of turning out 10,000 incandescent lamps every day, and I have no doubt that the annual production at this moment is to be counted by millions. Of incandescent central stations, there are two classes, one of which is the three-wire system, in which a continuous current is supplied to the main conductors over a town, and the lamps are connected by branches to the system of positive, negative and intermediate mains. That is the system which is so largely adopted in all the Edison stations; it was the Edison stations which interested us most in 1884, and they have continued to advance and have developed the three-wire system to a very great extent indeed.

But I feel quite sure that the greatest progress that has been made in central station lighting in America since the Association visited it has been by the work which Mr. Westinghouse has done in that country. One of Mr. Westinghouse's agents in passing through Europe saw the experiments which had been made by Messrs. Gaulard and Gibbs in this country in the use of alternating currents to distribute the electric light; by means of this system an alternating current of very high tension could be passed along the streets over conductors of very thin diameter and very cheap to construct, and at the consumer's premises this high tension dangerous current could be reduced in tension by means of an induction apparatus called a converter, and passed into the house at a harmless pressure suitable for the ordinary incandescent lamps.

And here I may say that I never fail to take any opportunity which presents itself to me to say what I feel with regard to the energy and determination with which Messrs. Gaulard and Gibbs, in spite of the most adverse criticism which was universally passed upon their first attempts, persevered and continued to improve their invention, and eventually proved to the world that it was possible to have a commercial system by means of these converters.

Mr. Westinghouse, on seeing this system, took it up, and the result is that he has established in the course of a very few years an enormous business in central station work. It is now a possibility in America—not a possibility merely, but a thing of daily occurrence—for a town to write an order for a central station, which has to be sent out at ten days' notice. They do not order a dynamo, set of conductors, and other apparatus all independently, but complete central stations are being sent out at a steady and uniform rate. In December of last year the manufacturers of incandescent lamps drew out a long list of the number of lamps being used in different parts of the country, and I have abstracted from that list some notes which show that at that time Mr. Westinghouse's alternating current system was supplying 153,285 lamps, occupying 152 distinct plants, and 42 of these had plant for more than 1,000 lamps. At the present moment they have set up 110 central stations with 191,000 lamps.

It has been said that in this country we do not go ahead so much as they do in America, and various reasons have been suggested to account for this. Professor Ayrton's most admirable reason seems to go a long way—namely, that there are two definitions of inertia, the English, which is that inertia is a resistance to motion, and the American, that it is a resistance to stopping. But I must say that in electric lighting we certainly have been stopped a great deal by what I might almost call the iniquitous Electric Lighting Act. And I regret extremely, in the interests of the public and of electric lighting generally, that an act has been passed this year which has not yet put electricity on the same footing as gas. This is a matter for extreme regret to all those who have the ultimate benefit of the electric lighting industry at heart, for that act will delay the due recognition of the value of electric lighting.

But I must say that I do not think the Electric Lighting Act is the only thing which has delayed our progress, because I see that in electric traction, and other developments of electricity also, the Americans have gone ahead with great energy; and I certainly do not put it down to want of capacity on the part of our inventors, for I find that the best dynamo machines are all designed originally in England, and the best arc lamps there are are to be found in England; but with inferior machines and lamps in the States, I have noticed that they are determined, as long as they have something which will work well, to make it work, and be ready in the meanwhile to take up something else. I think, therefore, that it is not in the inventors that we have to look for go-aheadedness, but to men of capital who are technically instructed. I think it is technical instruction among the moneyed classes that has developed electrical engineering so much in America of late years.

I will now try to describe some of the leading features of the Westinghouse central stations which I visited, and perhaps this may be of use in helping us to draw some conclusions as to the lines in which we are to develop electric lighting in our own country. I do not in the least wish to say that the American arrangements are the best. In many points I see objections, and many where I should wish to see improvements; but we have in the system which I am going to describe a thoroughly successful working arrangement, and although we in this country may not adopt all the points of such an arrangement, still I feel that it will be of use to us to realize what is being done on the other side. It is a curious thing, for example, that in America there is no work hardly being done with accumulators. There is an example where we have led the way, as compared with the Americans. I was struck with the fact in 1884, and still more in the present year, that accumulators do not seem to work in the American atmosphere; at any rate, people have been importing numbers of accumulators, and yet they are not recognized as the satisfactory apparatus we have come to regard them as; they are looked upon there as being as uncertain now as they were with us four or five years ago.

The Westinghouse system, then, chiefly depends upon the apparatus which has been called by the names secondary generator, transformer, or converter; "converter" is the term generally adopted in America. This is simply an induction apparatus with two coils, a primary and a a secondary. The primary coil, in contradistinction to the ordinary Rhumkorff induction coil that we have known so long, is of high resistance, with a large number of turns on the primary and a small number on the secondary which goes to the lamps. The alternating current produces induction in passing through the primary, which reacts on the secondary, thereby producing a current of low tension going into the houses. The primary coil and the secondary are completely separated, and when properly constructed it is quite impossible that the high tension current can ever reach the secondary circuit, so that the consumers of electricity have nothing to fear from the dangerous current which is distributed from the central station.

A central station contains furnaces and boilers, engines, alternate current dynamos, exciting dynamos, switch-boards, testing instruments, repairing shop, and stores. The scheme of arrangement of the mechanical and electrical parts is generally the same in every station.

The wires led out from the station are carried generally on poles as feeders to the separate districts. The converters are generally attached to the outside wall of the house to be supplied; but they are often attached to the poles carrying the feeders. They are sometimes placed inside the houses. The secondary wires inside the house, to which the lamps are attached, are laid in the usual manner, and are connected to the secondary poles of the converter. The dynamos are run day and night without cessation. Charges are made by contract or by meter.

We hear a good deal here of the impossibility of running machinery day and night without breakdowns, and I cannot help rather indorsing the opinion I heard universally expressed in America—that this fear has been enormously exaggerated in this country. When we see our huge 10,000 to 15,000 horse power engines crossing the ocean, performing their work for days and weeks without breakdown of any sort, it seems absurd to expect that where we are able to subdivide our power, as in a central station, there should be any serious breakdown in a properly organized system. As a matter of fact, I assure you that in America plants which have been run without accumulators have been going on for years and years, and it is a matter of the utmost rarity for an accident to arise of sufficient importance to stop the general lighting of the district. The Edison central station in Pearl street, New York, which has been running many years, has, I believe, only once broken down, and that was an accidental occurrence due to too much current being turned on on a foggy day; and the experience of other central stations is to the same effect. The general view in America is that there is no danger of a breakdown ever happening in a properly organized station.

It happens that in the department of furnaces and boilers there is much of special interest in many of the Westinghouse stations. This arises from the fact that over a great part of Western Pennsylvania the fuel employed is the natural gas obtained from the wells in that region, and carried in pipes to considerable distances. But this is a feature so peculiar to the district that it requires only a short notice here.

The gas, with its due proportion of air to produce the high temperature of a Bunsen burner, is admitted by pipes with a sufficient number of nozzles into the combustion chamber. Here the burning gas passes over a mass of bricks with ventilating spaces, and thence through the tubes of the boilers. The gas is nearly free from carbon, and the hydrogen, which is paramount, undoubtedly weakens the iron of the boilers; but practice shows that this action does not go far, and the iron acquires a final condition in which it does not deteriorate, but seems capable of indefinite use.

In the best stations the admission of gas and air to the furnaces is regulated by means of a valve controlled by a lever, which in its turn is subject to the pressure of the steam in the boiler. This automatic regulation is very perfect, so that the attendance of one man to the boilers and furnaces of a station with several thousand horse power is quite sufficient.

As to steam engines there is no need to say much, for I do not think the Americans can teach us anything about making steam engines. But there are some points in connection with the class of steam engine used which I think are of importance. A great deal has been said about the desirability of having central stations furnished with large, powerful, slow-running engines which are economical in the consumption of coal. Practical experience, however, has decided the question for the present exactly in the opposite manner. It is found to be more economical and safer to have a number of dynamos in each station, each driven by a separate engine of high speed, the power being transmitted through a belt and with no countershafting. About the rights of this question there cannot be the slightest doubt. It has been proved over and over again by experience. At first sight it does not seem probable that a number of independent high speed engines should be more economical or safer than a single large engine, say, of the marine type. The explanation lies in the special conditions of central station lighting. Without dwelling upon the great loss of power due to countershafting with the large engine, it is only necessary to observe that the maximum load in a lighting station is many times as great as the average load. Thus, if the single engine be adopted for the maximum load it is working underloaded during the greater part of the 24 hours. The consumption of steam in proportion to power developed is very high, and the engine is, under these circumstances, not an economical one. With the independent engines, on the other hand, none of them need at any time be working much under its best load, and when the load increases other engines and dynamos can be switched in, and they are thus always working at or near the most economical conditions.

It has been found from actual practice in electric light work in identical central stations that 20 per cent. more work is required in the case where countershafting is introduced.

It has also been proved from the experience of numerous central stations that during a considerable number of hours in the night the load on the engines and dynamos is only one-eighth part of the maximum load.

For these reasons it is found most economical to use with each dynamo an engine whose most economical load is something like 20 per cent. under the maximum load. Waste of steam is far greater with underloading than with overloading.

Another advantage of this system is that there is abundance of time for the inspection of engines and dynamos. The station is easily added to. A breakdown in an engine or dynamo does not stop the working of the station. There is one other factor of safety to which attention must be drawn. One of the most annoying accidents in an electric lighting plant is that due to a short circuit on the mains. In overhead work this often happens by the falling of broken telephone or dead wires upon the mains. In this case a small independent engine is pulled up and no damage is done. With the large engine the dynamo grinds on, and unless the cause of short circuit is burnt up the dynamo is destroyed, or at any rate the whole of the working is put out of gear.

Now I have a word or two to say about dynamos and converters, the actual apparatus which are used in America. I attribute a great deal of the manufacturing success of electric lighting plant to this, that they fix upon the types of machine that they are going to make, and then lay down machinery which will enable them to produce those types cheaply, and having thought out the system thoroughly in the beginning, they do not require to make a completely new type of machine for every order that comes in. They are then able to manufacture their machinery cheaply, and in such a way that every part is replaceable.

At this moment I think if I had to choose between two dynamos of which one was a little better than the other in efficiency, but the other of which was manufactured in this way, I should be very much inclined to lean in favor of the one which was made by machinery, and of which all the parts were interchangeable, and of which I could get any one of the parts by return train by telegraphing for it. The convenience of such a machine is obviously great.

I have, for the benefit of those who are electrical engineers and manufacturers, thought it might be of interest to put down some facts in connection with the three types of alternating current dynamo machines made by the Westinghouse Company. There are three types—one for 650 lights, another for 1,300, and another for 2,600. The voltage of all is the same—1,050. In this country there has been a tendency to use on the primary circuit a higher tension than that—2,000 volts. In the Westinghouse system they use 1,000 volts at the converters, and 1,050 is developed by the machines. The local pressure is reduced in the same proportion as has been done most generally in Europe; that is to say, in the ratio of 20 to 1. The 1,000 volts in America is reduced down to 50 volts in the lamps, and in this country the 2,000 volts has been reduced to 100 volts at the lamps. And here there is a question opened which must be decided immediately in the central stations which are going to be put down in this country—whether you are going to take the full advantage, as Mr. Westinghouse does, of being able to carry your high tension current in the mains.

The advantage is that you are able to save copper to a very great extent indeed, whether you use 1,000 or 2,000 volts, and then, as Mr. Westinghouse argues, we are able to use lamps of only 50 volts instead of lamps of 100 volts. That he looks upon as the greatest advantage he has gained by the introduction of the Gaulard and Gibbs system. We all know that the higher the voltage of the lamp the shorter its life, and a 50 volt lamp is a far more perfect thing than a 100 volt lamp. We are greatly troubled with the expense of lamps compared with their life. That is an expensive item in the supply of electr city, and, a 50 volt lamp being far more economical, is it not desirable to follow the American plan and use the lower voltage? I am sure that electrical engineers generally will see a point worthy of their serious consideration in this question.

It may even be said that we are all to go still further and reduce the voltage a great deal more. Of that I am less certain; but there is another point which will occur to electrical engineers whether it is not desirable to use the lamps which Mr. Bernstein has been perfecting, of very low voltage, placed in series. At present one of the most serious difficulties in introducing electric light for domestic purposes from central stations is in the cost of wiring houses. Now, if we place our electric lamps all in series, the cost of wiring will be very much diminished, and it becomes a question whether this is not the best arrangement. In that case the primary coils of our converters would be put in series in the same way as they were originally in the Gaulard and Gibbs system. We shall then be doing what they were striving to do when they chose the series arrangement, namely, not by having the two primary terminals inside the house at a difference of potential at 1,000 or 2,000 volts, which would be dangerous, but no two conductors of greater difference of potential than about 50 or 100 volts. If at the same time we use low voltage lamps, we shall get a longer life than even Mr. Westinghouse has obtained. It seems to me that there are grave reasons for considering most seriously the question of arranging all our lamps in series and the primary coils in our converters in series also.

But I am not here to put forward suggestions about what we may probably do in England, but only to tell you what they are doing in America, wishing at the same time to guard myself from saying that they have the best arrangements in every possible point.

The construction of the Westinghouse dynamo is pretty well known in this country, and it is needless to speak of it.

I think we are probably all agreed that the old type of alternating current dynamo, such as the Siemens, has probably seen the end of its days. One of the chief difficulties seems to be that when you have such a large number of coils revolving between the poles you are obliged to make a considerable clearance, and that causes you to use up a great deal of power in magnetizing the field magnets. Mr. Westinghouse makes a very small clearance, and in that way uses up only 2 per cent. of the maximum power.

The Westinghouse Company makes those types of dynamo, of which the following particulars are of interest:

Dynamo No.	i.	ii.	iii.
E. M. F.	1050	1050	1050
Current	35	65	130
Resistance (armature) at 30° C.	.76	.37	.15
" (fields) " C.	14.5	7.0	3.6
Weight of Wire in armature	17	30	60
" " " fields	420	..	..
Total weight	4800	9000	..
No. of lights	650	1300	2600

The No. iii, has an armature about two feet diameter and two feet long. It has 16 poles, and runs at 1,000 revolutions per minute. The armature plates have each six large holes for ventilation and lightness. The weight of armature is 2,000 pounds. The insulation is mica and copal varnish, which is found to be infinitely superior to shellac or any other material tried.

The converters used by the Westinghouse company are of five sizes,

called by the numbers i., ii., iv., vi. and viii. The following table gives particulars about them. The size of wire is on the B. and S. gauge :—

Converter.	i.	ii.	iv.	vi.	viii.
No. of lights.....	5	10	20	30	40
Wire on primary.....	25	22	19	17	16
" " secondary....	11	8	8	8	7
Turns on primary.....	900	700	560	480	400
" " secondary...	45	35	28	24	20
Resistance of primary..	48	21.9	9.9	7	5
" " secondary	.04	.043	.0197	.0176	.0107
Weight finished (lbs.)..	50	60	95	..	160

Thickness of iron plates = .006 to .0065 inch.
" " paper insulation = .0025.
Number of plates in a No. 8 converter = 1350.
The iron used in Welsh Taggard iron.
50° C. rise in temperature is allowed in the converters.

In this country the tendency is to make converters much larger ; it has even been suggested that they should be made of thousands of lights. But for ordinary use in houses the Westinghouse system is the simplest, more especially as we find that it is necessary to wire the houses in such a way that they will suit our meters, which at present do not go over a range of from one lamp up to a thousand lamps, nor even up to hundreds of lamps, and if we find that our range is suitable up to 40 lamps it is very desirable to wire the houses in such a way that there are not more than 40 in the circuit of a meter indicating 40. For this reason Mr. Westinghouse has limited his converters in this way.

There are some points well worthy of attention in regard to converters. In the first place, by the use of only 1,000 volts, a far cheaper converter may be made, and thus a great saving may be effected in the plant required for a house. Then, again, there is the rapidity of alternation. In the Westinghouse plant there are 16,000 alternations, 8,000 complete periods, per minute. In this country the tendency is to make the alternations less than that. The quantity of iron you put in your converters depends on the number of alternations ; the greater the number of alternations the less iron is required, and you are therefore able to use smaller converters. I do not know whether or not there are objections upon other grounds to a high number of alternations. The only objection that occurs to me is that, while the construction of the dynamo sometimes becomes a little easier, it also takes a little more space.

Mr. Westinghouse asked me to make some tests for him on the efficiency of his converters. It has been supposed that converters have not a high efficiency when working at half load I may mention that the efficiency varied slightly in the different types, owing to the proportions of iron being greater in some types than in others ; but at half load in some cases we were able to get an efficiency of 95 per cent., which is a splendid result, and I think a greater efficiency than most people have been supposing was to be attained. I do not think that in actual practice there is an average waste of 10 per cent. in the use of the converters, when they are properly designed. The formulæ which regulate the construction of converters have been given by me in the *Journal* of the Society of Telegraph Engineers and Electricians, February, 1888.

I may also say that Mr. Westinghouse has in his lamps 70 per cent. of the power given to the belt by his engine, which is a very good return for converters and alternating dynamos, showing that the new alternating current machines are much superior to the old one, which gave about 70 per cent. efficiency.

The wiring is nearly all overhead in the States. The wire used is called simplex wire, and is made by a firm in Boston. It is very carefully prepared, and is, I think, beginning to be known in this country, and gives satisfaction.

For underground work Waring cable, which is lead-covered, is used with complete success. I am informing you now of what is being used, and used successfully, and what may be used successfully by us in this country ; but you must not suppose that I hold that these arrangements are the best.

Now comes a most important point of distribution. Ought the conductors to be massed in one heavy main, with all the dynamos feeding it, or ought the main to be much subdivided, with, perhaps, several to each dynamo ? or ought we to take an intermediate arrangement ? The experience of the Westinghouse company leads to the subdivision of mains as far as possible, because a short circuit on any main then endangers only one dynamo.

I have often been asked the question whether alternating dynamos can be worked in parallel. They can when they are fully loaded down almost to half load, but below that they do not synchronize. Great subdivision of the mains has been found in practice to facilitate largely the working of the central station.

There is one thing that will probably be spoken about in the discussion which will follow my remarks, and that is the high speed of the Westinghouse dynamo. I think there is needless objection to high speed by engineers in this country. If we have a uniform cylinder of iron revolving I have no objection to any rate of speed so long as I know the shafting will not give way.

I think it would be desirable that some of the gentlemen present should give us their views as to the desirability of using a high or low number of alternations, high or low voltage in the primary, whether 50 volts will be desirable in use, and also as to whether subdivision of mains is desirable, and whether the converters should be supplied with only a limited number of lamps, such as 40 or 50.

I have now attempted to give you a general idea of working central stations in America on the system which has been most fully developed of late years. It is the result of a great amount of careful work, and in the work of the immediate future in England I am sure that English engineers will be benefited by the large practical experience which our trans-Atlantic cousins have collected.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, Dec. 10, 1888.

Death of Dr. Wallace and Mr. John Leigh—Leakage of Gas at Carshalton—Standard Threads for Meter Connections—Liquid Fuel for Raising Steam—A Modern Sulphate Apparatus—Gas Enterprise in South Africa.

Two noted names have recently been removed from the ranks of workers in the gas industry by the death of Dr. William Wallace, of Glasgow, and Mr. John Leigh, of Manchester. The latter gentleman had reached a ripe old age, but the former passed away at the comparatively early age of 56. Both were known as expert analytical chemists, and as such occupied public positions in their respective towns. And both had taken up the numerous scientific problems that are afforded by the processes incidental to the manufacture, purification, and consumption of coal gas as a part of their regular occupation. Dr. Wallace, in particular, was a most industrious worker. Notwithstanding many other engagements, he managed to find time to compile a vast amount of useful information for gas engineers. The work with which his name will be principally associated in the future is that giving the results of his investigations into the properties of various kinds of Scotch coals, cannel, shale, etc. In this book, particulars as to yield of gas, quality of same, composition of coke, and other practical details in respect to over 200 different minerals are given. Another important duty discharged by Dr. Wallace was the labor consequent upon his appointment by the British Association, about ten years ago, as one of a committee of three for the purpose of reporting on the best means of developing light from coal gas of different qualities, and which resulted in the publication of a long report in three annual installments. He took a great interest and occupied a prominent position in connection with the Philosophical Society in Glasgow, occasionally reading papers on gas and other subjects, and especially in serving as a juror in connection with an exhibition of gas and electric lighting apparatus held under the auspices of that Society. He also presented several papers to the Gas Institute—one as recently as the last meeting—and took part in the proceedings of local gas managers associations.

Mr. John Leigh at one time took great interest in the subject of gas purification, and was the author of several patents in connection with that branch of gas engineering. He was the discoverer of nitro-benzol, and also of the fact that coal gas contains other valuable illuminants besides olefiant gas, which was formerly supposed to be the sole source of luminosity. It may be said of both gentlemen that there was scarcely any question, from the selection of suitable gas-making materials up to the best method of utilizing the gas on the premises of the consumer, that was not favored with their attention ; and that careful and painstaking research of the kind which these chemists have done so much toward developing, is mainly to be credited for the present position of our knowledge on the subjects of gas manufacture and purification.

A somewhat amusing case lately came before the High Court of Justice, relative to a leakage of gas at Carshalton, a little town in Surrey. Some of the escaping gas, which is no respecter of persons, dared to intrude into the wine cellar of a solicitor residing in the neighborhood. This gentleman, careful of the value of his liquors, at once incurred considerable expense in endeavoring to keep the gas out. The cost of these alterations, together with a modest *douceur* of some 20 per cent. on the value of the wines as compensation for injury supposed to be caused by the gas, and a few incidentals, formed a substantial bill of damages which he presented to the Carshalton Gas Company, and, when they demurred, endeavored to enforce from them by the aid of the law. A matter of fact jury, however, did not take the same view of things as this imaginative Carshalton solicitor. They reduced his claims from the important figure of about $600 down to $25, and further found that the Gas Company had not been guilty of negligence in the matter of the leakage. The opinion of the Judge was that the Gas Company could not be held liable unless negligence could be proved, and judgment was therefore pronounced in their favor. So the plaintiff is not only left without any solace to his wounded feelings or tainted wine, but also has a bill for expenses to pay.

The question of how it is possible for gas to penetrate corks and spoil the contents of bottles of wine is a rather difficult one. The only way of getting an answer is by practical test. A few days since a friend who is the keeper of a first-class hotel, and therefore maintains an extensive and *recherche* cellar, mentioned to the writer the existence of a slight escape of gas in his cellar due to the negligence of a gasfitter, and anxiously asked if it would injure the wine. By way of answer he received a promise of personal examination into the matter. On a visit to the

cellar being paid, the desirability of a practical experiment on this important point was delicately suggested to him, and a bottle of the best champagne was accordingly selected. The only philosophical apparatus required was two glasses, wide in the brim and narrow in the stem, and the satisfactory result that the wine was not injured in any way was unanimously arrived at. Had the gentleman at Carshalton followed this course, it would have proved pleasanter and also cheaper than the position he chose to take up.

I notice that a definite conclusion on the subject of standard sizes of screw threads for meter connections has been arrived at by the American Gas Light Association. It has occupied the attention of Government officials here. An annual report is issued by the Board of Trade, giving the particulars of their proceedings under the Weights and Measures Act of 1878, and the latest of these reports includes an illustrated description of a set of steel gauges that have been prepared, including full particulars of the various dimensions. These have been designed after consultation with the Council of the Gas Institute and other interested persons, all of whom admit the need for standard sizes in connection with gas meter connections, and it is believed that they will meet with general approval. Of course the introduction of these standard sizes, by gradually substituting them in the place of the numerous varieties that at present exist, will be a matter of time and of some temporary inconvenience; but the end in view will be well worth the trouble.

Some experiments on the use of tar and other liquid fuels for raising steam, both in stationary and locomotive boilers, have been in progress on the works of the Great Eastern Railway Company for two or three years, under the care of Mr. James Holden, Locomotive Superintendent to the Company. One object in view appears to be the utilization of tar produced at the oil gas works, where a rich oil gas is made under Pintsch's system for lighting the railway carriages; but the general question is, of course, the relative cheapness of coal and of liquid fuels as compared with their efficiency. A small stationary boiler of the Cornish multitubular type, worked to give about 60 pounds steam pressure, was found to require about 97 pounds of coal per hour. When supplied with tar from the oil works, the consumption per hour was 66 pounds of tar and 3 pounds of coal. So it appears that 66 pounds of tar are equal in calorific effect to 94 pounds of coal. It is noticeable that Mr. Holden does not alter his furnace in any way for the use of the liquid. He simply maintains a very thin coal fire all over the grate, and uses lumps of chalk to assist in keeping the grate covered. The liquid is introduced by means of a steam injector having three concentric nozzles, of which the center one is for steam, the next admits the liquid fuel, and the outer one a current of air. Three stationary boilers of the locomotive type, worked at 80 pounds steam pressure and fired with Staveley coal, required 275 pounds of coal per hour. When coal and green oil were used together the consumption was 101 pounds of coal and 99 pounds of oil; from which it may be gathered that 99 pounds of green oil were equal to 174 pounds of Staveley coal. A locomotive fired with one-third green oil and two-thirds tar required one gallon of the mixture and 14 pounds of coal per mile run, and the fuel was completely consumed without the production of smoke. It was found that locomotives could be worked with tar advantageously as compared with coal, when the cost of the liquid was not more than 1½d. per gallon, which is equivalent to about $4.75 per ton. The fact that the liquids are more effective, weight for weight, and that they are not burdened with inert matter in the form of ash and clinker, is of great importance in the case of locomotives and steamships which have to carry a supply of fuel. And these experiments ably illustrate the heat-giving energy of liquid fuels, and show the importance of seeking to turn such to practical account in districts where tar or oil residues are a drug on the market.

A recent number of *Industries* contains an illustrated description of the plant used for the manufacture of sulphate of ammonia at the Wear patent fuel works. It comprises a boiler that can be heated either by "wet" or by "dry" steam—that is, steam allowed to escape into the liquid, or inclosed in coils—closed saturators, settling tanks, and evaporators. The waste gases are caused to pass through two scrubbers, where they are cooled by jets of water, and then conveyed to oxide purifiers. When the fresh charge of liquor is admitted to the boiler, "wet" steam is turned on, but as soon as the liquor is raised to boiling point this is stopped, and the boiling is maintained by means of a steam coil. Lime is used for displacing the fixed ammonia, being injected into the boiler at the proper time by water pressure. The apparatus is capable of dealing with a charge of 3,000 gallons of liquor in from 8 to 18 hours according to the strength. It does not represent any very important improvement on that generally used in gas works, under the title of the closed saturator or the evaporation system. The only novelty about it is the use of both wet and dry steam, which is certainly an advantage.

South Africa appears to be exciting attention as a field for the introduction of artificial lighting. A company has been formed, under the title of the South African Lighting Association, for this purpose, including the acquisition of existing and the erection of new works, and the supply of apparatus for lighting by gas, electricity, or oil. The registered office is in London, and there is a strong directorate. Mr. Corbet Woodall visited South Africa on behalf of the promoters last year, and advised the Company to purchase the undertaking of the Port Elizabeth Gas Company, and to undertake the lighting of King Williams Town; and the Company propose at once to purchase the Port Elizabeth undertaking for a sum of £36,000, and to erect gas works at King Williams Town at a cost not exceeding £18,000. Negotiations with other towns are also in progress. Only a year or so since another undertaking, called the South African Gas Company, was formed for the purpose of supplying a district in the neighborhood of Cape Town, and they have just laid the foundation stone of their new works. Up to the present time Cape Town and Port Elizabeth are the only places supplied with gas in the locality, so there is plenty of room for the development of these new enterprises. Mr. T. Newbigging, the well known gas engineer, has lately proceeded to South Africa under an engagement with the Cape Town Corporation, for the purpose of examining and testing the native coal with a view of ascertaining its suitability for gas making. He is also to report as to the desirability of erecting a gas works at Johannesburg, the capital of the Transvaal, together with the cost and other details.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. GEO. S. HARRIS, Superintendent of the Mansfield (O.) Gas and Electric Light Company, writing under date of December 21, says: "We have completed arrangements with the McKay-Critchlow Manufacturing Company, of Titusville, Pa., to put up in our works their system of water gas. The plant is to have a daily capacity of 120,000 cubic feet, and is to be completed by February first."

AT the annual election of the stockholders of the Laclede Gas Light Company the retiring Board of Directors was returned without opposition. The executive management remains as before. It could not very well be improved on.

MR. JNO. H. MICHENOR has been named by the City Councils of Philadelphia as a Trustee of the Northern Liberties gas works of that city.

AT a meeting of the Directors of the Burlington (Vt.) Gas Light Company ex-Mayor J. D. Hatch resigned from the Presidency and Board of Directors of the Company. We are sorry to have to say that this action was taken by him because of ill health. Mr. A. G. Peirce was chosen to fill the vacancy created in the Board, and General William Wells was named to the Presidency. We hope that a protracted vacation will completely restore Mr. Hatch to all his old-time vigor and usefulness.

MESSRS. H. R. STRATTON, J. Amesbury, J. Deacon, J. W. Porter, C. H. Peix and W. E. Hurd will present a petition to the General Assembly of Connecticut for a charter granting them the right to operate a combined gas and electric light plant in the towns of Danbury and Bethel. They propose to operate under the title of the Peoples Illuminating and Heating Company. If the Connecticut General Assembly is wise, and judging from its past record in the instance of granting opposition gas charters it must be put down as having been so, the Danbury promoters will not be enabled to embark in the artificial lighting business as speedily as they would seemingly like to.

ANOTHER screw seems to have dropped out of the framework of the Associated Press man, for, by way of Lima, Ohio, under date of Christmas, he gravely heralded the following: "Miss Hattie A. Proctor, with her attorneys, S. H. Fletcher and T. E. Hall, of Chicago, is here experimenting with Lima crude oil with a new process for converting it into gas. Miss Proctor is the owner of the apparatus with which it is claimed 10,000,000 cubic feet of gas can be extracted from one barrel of the oil. If the test is satisfactory it will be the means of introducing the cheapest fuel ever known." He concludes by saying, "The result will not be known for several days." And we think he is right. Mr. Johnson's results, by-the-way, have not been given to the world, although some years have passed since he promised to make a barrel of crude petroleum yield only one-half million cubic feet of gas. Miss Proctor

must evidently be classed as a veritable sunflower. The daisy division is altogether too lowly for her rank.

THE arrangements for the consolidation of the gas and electric lighting interests of Portsmouth, N. H., have been completed and the merger effected.

WE are told that Messrs. Widener and Elkins are the capitalists who are behind the Philadelphia Gas Improvement Company in an attempt to prove that wood gas contains great possibilities. They are experimenting with an invention for this purpose devised by a Cuban, Senor Jose Vivo.

THE Inter-State Gas and Water Works Company has made a proposition to the authorities of Washington (Mo.) to construct and operate a gas and electric light plant there, provided a 20-year exclusive franchise can be obtained.

WE are indebted to Mr. C. E. Hoover, Supt. of the Winchester (Va.) Gas Company, for the following extract from the Winchester *Times*: "Mr. Lester L. Kingsbury, Supt. of Construction for the Marr Electric Light Company, called to see us some days ago. He was much encouraged by talks with our citizens, and will soon submit a proposition for 33 arc lights, which he located while here." Our understanding of the above hint is that the Winchester Gas Company proposes to operate electric lights in connection with its gas supply, but we do not believe that the Company has yet decided on the system that it shall employ.

THE special committee appointed some time ago by President Smith, of the Covington (Ky.) City Council to consider the following proposition submitted by the Gas Company, reported favorably. The proposition was that the Gas Company would agree to reduce the price of gas to ordinary consumers to $1.50 per 1,000 cubic feet, if the authorities would agree to pay $1.25 per 1,000 (for the next two years) for the gas used for public purposes instead of the $1 rate now in force—the latter price to be restored at the end of the stipulated two years.

IN connection with the consolidation of the gas and electric lighting interests of Portsmouth, N. H., it may be further said that the owners of the electric property were paid $65,000 (in new shares of the Gas Company, taken at par) for it. This new stock emission brings the Gas Company's stock to a total of $142,000. No. increase will be made in the charge for the electrical service, but the plant will be at once removed to the Gas Company's premises on Bow street. The committee that had the matter in charge, who certainly went over the ground with extreme thoroughness, figure out a saving annually in actual expense of something like $5,000, representing a fair dividend on the money invested in the new purchase.

WE learned a short time since that Mr. Chas. S. Spaulding, Superintendent of the Brookline (Mass.) Gas Light Company, had been seriously ill with pneumonia. From a recent dispatch we are pleased to be able to inform his many friends that Mr. Spaulding is now convalescent, and trusts in a short time to regain his normal condition of health and be able to attend to his usual duties.

THE Worcester (Mass.) *Spy* is authority for the following statement: "The Gas Company at Spencer, Mass., has advanced the price of gas from $1 to $1.25 per thousand." If this is the fact it looks very much like progressing backward.

IN answering the mandamus brought by the Roman Catholic High School against the Director of Public Works to order the city to put gas into the new building at Broad and Vine streets, Assistant City Solicitor Alexander has declared that the city is not chartered to furnish gas; that it does its gas business in a private way, and can sell to those it pleased, and refuse anyone whom it desired; and that he doubted very much whether the High School could force the city to do what it desired. There is an unpaid gas bill of many years' standing against the property occupied by the school.—*Phila. Record.*

CANING A WORTHY MAN.—On Christmas Day the employes of the Macon Gas Light and Water Company, recognizing the fact of the uniform courtesy and even and exact justice always manifested towards them by their Superintendent, Mr. A. E. Boardman, determined to present him with some token of their esteem. This was done by presenting him with a handsome gold-headed walking cane as a souvenir of the Christmas time, with the following inscription: "Affection's tribute—from employes Macon Gas Light and Water Company, to Supt. A. E. Boardman, Christmas, 1888." And on the end of handle: "Our little Corporal."

SECRETARY GILBERT, of the Grand Rapids (Mich.) Gas Light Company, tenders the gas consumers of his city the compliments of the season, and announces the fifth consecutive annual reduction in gas rates. Commencing with the 1st inst., the price to those using 10,000 cubic feet or more monthly will be $1.20 gross and $1 net per thousand; from 1,000 to 10,000 cubic feet, $1.50 gross and $1.20 net per thousand. For less than 1,000 cubic feet monthly there will be no change in the price. Secretary Gilbert, in his letter notifying us of the reduction, says, "We are getting there at the head of the procession." We think so; and we congratulate Mr. Gilbert and his Company on being able to continue the progressive strides commenced years ago, and trust and believe that the concession will prove as beneficial to the Company as such fair and liberal treatment of its patrons certainly should.

UNDER the supervision of Mr. Joseph Gwynn, who took charge some six months ago, the works of the Steubenville (O.) Gas Light and Coke Company have undergone many alterations and improvements, and others are now in progress which, when completed, will represent an expenditure of over $65,000. Among the additions to the gas plant proper is an entirely new and detached governor house, 13x40 ft., one story high, with deep basement. The building is of brick, with cut stone steps, sills, and window caps, and when finished will be one of the finest governor houses in the State of Ohio. Besides containing a Connelly automatic governor, this structure will also furnish quarters for the station meter. But little alteration will be made to the present retort house, except to so change the roof as to make it conform with a new building to be erected on the north side. The coal shed, which is now open, will be inclosed; the exhauster room will be wainscoted and finished to the style of a model machine room, and the purifying room will be fitted in a similar manner. The principal addition to the works of the Company consists in the new building to be erected for the accommodation of the electric light plant which it is proposed to operate. This structure has a frontage of 118 feet, and is to contain a plant with a capacity of 300 arc lights of 2,000 candle power each, and 3,000 incandescent burners of from 16 to 25 candle power each. The first room in the new building is the boiler room, 35x34 ft., in which will be placed a battery of five boilers, each 5ft. 6in. in diameter and 16ft. long. These boilers will connect with a huge stack on the outside. This stack rests upon a cut stone foundation 10 ft. square, and is 62 ft. high. Adjoining this room is the dynamo room, 65x34 ft., in which will be placed the engines and dynamos. Both the boiler and dynamo rooms are 20ft. high, and will be wainscoted and finished in a handsome style. There will be four engines in the dynamo room, with double settings, with backs to each other in the middle of the room. The dynamos will be at both ends, and steam will be conveyed to the engines by drop pipes from the ceiling. The engines will each be of 150-horse power, and will be of the finest quality of workmanship. The north end of the building will contain two offices, each 15ft. square, which will be elaborately furnished. When the roof of the retort house is made to conform with the new building, the solid frontage of 180 ft. will present a very handsome appearance. All the rooms will be lighted by large windows, and the roofs will be of very heavy corrugated iron. The system of electric lighting to be employed has not yet been fully decided upon, but it will probably be either the Thomson-Houston or the Edison. The electrical annex will operate under the name of the Steubenville Electric Light Company, but its incorporators are the members of the Gas Company. The design and plans for the improvements and additions throughout were made by Mr. Gwynn, who has been practically given *carte blanche* for this work by the Company. The Steubenville Gas Light and Coke Company has been in operation for 37 years, and now has 17 miles of street mains, one of which is 8 in., the remainder being 4 in. pipe. The capacity of the gas plant is 150,000 cubic feet per day.

A WAR is in progress between the rival electric lighting companies of San Diego, Cal., and patrons are looking forward to a lowering of rates.

ALD. MCGREGOR, of the Chicago Common Council, has introduced an ordinance granting a franchise to the Standard Gas Light and Fuel Company to construct and operate a gas plant in the west division of that city. The matter was referred to the Committee on Gas for their deliberation.

MR. W. H. JUDGE, who fills the triple office of Secretary, Treasurer and Superintendent of the Rock Island (Ills.) Gas Company, has presented the gas consumers of that town a New Year's gift in the shape of a considerable reduction in gas rates. The announcement states that on and after Jan. 1, 1889, the price of gas will be $2 per thousand cubic feet, with a discount of 25 cents to those who pay their bills promptly,

and a further rebate of 25 cents per thousaud on bills showing a consumption of 20,000 feet per month. Mr. Judge turns out an excellent article of pure coal gas, and supplies it at a price that should insure its extensive use for heating and culinary purposes as well as for illumination.

THE list of holders built by the firm of Deily & Fowler, of Phila., Pa., during the past season is as follows:

Lancaster, Pa.....	100 x 26 ft.	Dover, Del.....	40 x 16 ft.
*Tacony, Pa.....	40 x 16 "	Calais Me.....	45 x 16 "
*Tacony, Pa.....	50 x 16 "	New London, Conn..	50 x 18 "
Mount Vernon, N. Y.	80 x 40 "	Westchester, N. Y...	37 x 14 "
Binghamton, N. Y...	70 x 34 "	Bay Shore, L. I.....	50 x 30 "
Concord, N. H.....	80 x 24 "	Washington, D. C...	152 x 70 "

*In wrought iron tanks.

The above list would indicate that the past year with this old-established and well-known firm has been one of considerable prosperity, with extremely short waits between orders. But busy seasons have been the rule with this Company for very many years, its corporate life representing a period of close upon half a century.

THE Austin (Texas) Gas Light and Coke Company, being anxious that its consumers should be put in possession of the best methods of utilizing the product it supplies them with, to the end that entire satisfaction may be the portion of all concerned, points out in the following circular how the gas bills may be reduced: "Control the pressure of gas, which will ordinarily vary from 1 to 3 inches. An open 5-foot lava tip burner will consume 5 feet of gas per hour under ½ inch pressure; 7½ feet per hour under 1 inch pressure; 9½ feet per hour under 1½ inch pressure; 11½ feet per hour under 2 inch pressure; 13½ feet per hour under 3 inch pressure. Any variation from the proper ignition pressure will cause a waste of gas and correspondingly increase your gas bills. With governor burners this is impossible. Every light but one on the premises or city may be extinguished, and this remaining one will consume just the same amount of gas as when all were lighted. 2. Adjust the size of your burners to your requirements. This is of the utmost importance. It is frequentlg found that burners of twice or thrice the capacity required are employed, with an unvarying result of large gas bills. Don't blame the gas company for this; the fault is with your burners." Governor burners are supplied by the Company at 50 cents each, and consumers are permitted to test them to their entire satisfaction before payment is demanded.

AT a meeting of the stockholders of the Quincy (Mass.) Electric Light Company, held Dec. 22, it was decided to increase the capital stock of the corporation from $35,000 to $60,000, in order to permit the placing of larger plant. The Company expects not only to supply additional arc and incandescent lights, but also to furnish power to operate the street railways of the city.

SUPT. PENN, of the Washington Gas Company (Washington C. H., Ohio) has made another improvement to the works in the way of added facilities for receiving coal. A side track has been constructed from the Dayton, Fort Wayne and Chicago railroad tracks, and coal can now be delivered upon the Company's grounds direct from the mines. The increased business of the Company had made this addition necessary, it being no longer practicable to haul coal in wagons, as was the practice formerly. Supt. Penn has met with no small measure of success in encouraging the introduction of gas cooking stoves and the use of gas as fuel for heating purposes.

IN the list of gasholders constructed by Messrs. Deily & Fowler during the past season, published elsewhere among these items, the largest will be seen to be that erected for the Washington (D. C.) Gas Company. This holder has a capacity of 1,200,000 cu. ft., and thus ranks well up among the holders of great magnitude recently built. It was completed in November, and has been since tested to its full capactity, Messrs. McIlhenny and Lansden expressing their entire satisfaction with the work in all respects.

THE Gas Company supplying the towns of Harrison and Kearney, N. J., has announced a reduction in rates to private consumers of 50 cents per thousand. The former price was $2.50 per thousand.

THE Edison Electric Illuminating Company, of Brooklyn, N. Y., has purchased as a site for a power station a plot of ground, 50 by 100 ft., on Pearl street, between Myrtle and Willoughby avenues. This location is in the vicinity of the county court house and the municipal buildings, and was doubtless selected with a view to supplying said buildings with the "light of the future"—sometime.

FOLLOWING is a batch of California items: The San Bernardino Electric Light Company has sold out to the Gas Company.——C. A. Klinkner is having plans prepared for a gas works at Golden Gate.——W. J. Landers has applied for a franchise to construct a gas works in the town of San Leandro.——The Board of Prison Directors have appointed a committee to report upon the cost of lighting San Quentin by electricity.

THE St. Croix (Me.) Gas Light Company has made a contract with the city authorities of Calais to light the latter town with electricity for a period of 20 months, at the rate of $72 per light. About 20 arc lights will be required.

Mr. J. T. LYNN, Superintendent of the Chattanooga (Tenn.) Gas Light Company, has, it is reported, resigned his position with the Company, the same to take effect on Feb. 1. Supt. Lynn has been connected with the Chattanooga Company for a number of years, and under his supervision the works were enlarged and improved until now the capacity of the plant is treble what it was when he took charge. Not only has Mr. Lynn been eminently successful as a gas man, but so popular was he that the citizens of the First Ward chose him in 1887 to represent their interests in the Board of Aldermen, and the term of this office does not expire until next fall. He was chairman of the Street Committee last year, and will serve as chairman of the Committee on Public Buildings until his departure next month. It is predicted that before many months of this new year have passed Mr. Lynn will be heard of in connection with gas matters at the place of his former residence—Evansville, Ind. The Chattanooga *Times* says: "Mr. Lynn stands high in social circles, and has a legion of friends who will sincerely regret to lose him. He is a good citizen in every sense."

ON the 10th of last month Mr. N. D. Hargrove submitted to the Board of Aldermen of the city of Richmond, Va., a proposition of Bartlett, Hayward & Co., of Baltimore, Md., to lease the city gas works. These gentlemen make the following offer: "Should our proposal meet with your favorable consideration it is our purpose to continue the manufacture of coal gas, as, from the proximity of the city to the mines producing the finest gas coal in the country, good gas can be made as cheaply as from other materials, and the large yield of coke from this process will enable all those who desire to avail themselves of the privilege an opportunity to obtain cheap fuel, as the coke is selling at 6 cents per bushel. Further, it gives employment to a larger force of men than any other process, which is a question of some considerable importance to the persons employed at your works, and to whom the loss of their occupation would be a hardship. We are prepared, in the event above referred to, to take charge of the works and commence, as soon as practicable, the urgent and necessary improvements in providing benches of retorts of the most approved construction, erection of new gasholder, etc. In these matters the experience and knowledge of your Superintendent, Mr. Adams, and the Committee on Light, would guide our action. Your appropriation for the maintenance of the gas works in 1888 has been $191,820.37, which amount would not be required in the future if the works were leased, which would permit of increased appropriations for the extension and maintenance of your streets, parks, public buildings, water works, fire and police departments, etc., in addition to which you would receive a yearly revenue from the lease. In conclusion, we desire to state that our offer will be for a good, pure illuminating gas, the quality of which at all times shall meet your required standard, and at a less price than is now charged to the consumer; and shall pay for the lease a price that will be mutually agreed upon by your honorable body and ourselves as equitable to both the city and the lessees."

AT a special meeting of the Common Council of Duluth, Minn., on December 20, last, the matter of public lighting was finally settled by the awarding of the contract to the Duluth Electric Light Company. The Jenny system will be employed, and the rate is to be 35 cents per light per night.

GAS escaping from a defective pipe found its way into one of the vaults of the County Court House at Waco, Tex., on Dec. 10, and when Deputy Clerk Thomas Brown entered as usual in the morning and struck a match to light up, a succession of explosions followed and he found himself enveloped in blaze. Mr. Brown jumped out quickly and closed the door behind him, thus extinguishing the flame. He was not seriously injured, and no other damage was done.

THE Cartersville (Ga.) Gas and Water Company, recently incorporated, is officered as follows: President, Geo. W. Chipman, Boston; Secretary, Hiram Blaisdell, Boston; Treasurer, Peter W. French, Bos-

ton; Directors, Elisha Thayer, Rev. Sam. P. Jones, John T. Norris, and E. E. Freeman. Mr. Hiram Blaisdell, who is to build the works, promises the Cartersville residents that gas will be supplied to them in a very short time.

On the 11th of last month the Grand Rapids (Mich.) Gas Light Company was the victim of an accident that resulted in the loss of some 300,000 feet of gas. It was caused by the breaking of an elbow under the east approach to the Fulton street bridge. The pipe was broken by the caving in of loose earth from above, the city workmen having been engaged most of the fall repairing sewer and water pipes. The break probably occurred early Tuesday evening, but the quantity in store was not exhausted till morning, so users were not incommoded. Consumers were requested to be economical in burning gas Wednesday night so that all might be fairly well supplied, as it was impossible to make enough gas to supply the amount lost the night before. Supt. Smith was obliged to keep the plant on the jump, but, of course, he was fully equal to the occasion.

Fire destroyed the electric light works at Springfield, O., on Dec. 14. The fire broke out early in the evening, and the streets of the city were therefore left in darkness, as were also those stores and business houses which had caused the removal of the gas meters from their premises.

The success of the Ross discharging machines having been amply demonstrated at the Point Breeze station of the Philadelphia Gas Works, the apparatus has been accepted by Director Wagner, and the financial end of the contract has been duly settled between City Controller Dechert and the United States Steam Stoking Company.

Mayor De Lashmutt, of Portland, Oregan, has returned to the Council without his approval an ordinance recently passed granting a franchise to the Willamette Falls Electric Company. Section 1 of the ordinance grants to said company "the right to locate, erect, place, use, operate and maintain in, under, upon and over the streets, alleys, public parks and public ground of and within the city of Portland, poles, wires and underground conduits for conducting, conveying and transmitting electricity for the purposes of lighting, power and such other purposes as electricity is now, or may hereafter be used." Section 2 provides that "the rights and privileges hereby granted are subject to reasonable regulation by the common council, but not so as to interfere with or prevent the said Williamette Falls Electric Light Company, its successors and assigns from carrying on the business of furnishing electricity for the purpose of illumination and power, and for such other purposes as electricity is now, or may hereafter be used." In reference to these sections Mayor De Lashmutt says: "How do we know for what purposes electricity may be hereafter used, and might it not become advisable at some future time to require that all wires shall be located under ground?" Section 2 of ordinance No. 3538 granted similar rights to G. W. Weidler over the streets of the city of Portland, with the additional safeguard that the rights and privileges granted should be "subject to modifications, limitations and change by the common council whenever in their judgment the public interest require it." This Mayor De Lashmutt thinks a wise precaution and should not be omitted in the ordinance under consideration. The erection of poles and stringing of wires and the general construction of the plant should, in his judgment, be under the supervision of some properly constituted city authority, such as the street committee or superintendent of streets, which has not been provided for in this ordinance. In conclusion the mayor remarks: "I can hardly believe that your honorable body intends to grant perpetual rights which would place the company completely beyond the control and regulation of the common council, which will be the case if this ordinance becomes a law.

The right of way through the Philadelphia Gas Works property was recently sold to the Schuylkill River East Side Railroad Company for the sum of $125,000.

The Pensacola (Fla.) Electric Light and Power Company started its works Dec. 13. Arcs only are at present used.

F. W. Crowell, an old employee of the Cambridge (Mass.) Gas Light Company, died Saturday, Dec. 8. Deceased had attained to the age of three score years and ten, 32 years of which had been faithfully devoted to the service of the Company in the capacity of foreman.

The Committe on Light of the Richmond (Va.) Board of Aldermen have recommended the appropriation of $7,100 to the Gas Department to supply a deficit in the account of the past year. They also recommended that $675 be applied to the extension of the gas main out to St. Paul street.

J. Sewell Read, Superintendent of Street Lights, Pawtucket, R. I., in his annual report states that by the reduction in price of the electric lights by the Pawtucket Gas Company there was a saving to the city of about $5,000 during the year. He says the time has come when the City Council should call a halt in the matter of increasing these lights, and for that reason he makes no recommendation the coming year for additional electric lights. There are now 177 electric lights in the city, the "all night" circuit being of great benefit to the police, as well as to all taxpayers. If the city can afford the extra expense he recommends the lighting of the entire city all night. He states that the rebate on electric lights for the year has been $155, and on gas lights $95, making a total of $250 rebate; that there are now 92 gas lights, a reduction of 18 from last year, caused by the substitution of electric lights; number of oil lights, 144, including 10 new ones put in during the year. The number of gallons of oil consumed has been 1,625; number of chimneys broken and replaced, 2,544; wooden posts broken and replaced, 14. The amount expended during the year has been $26,776.65, leaving a balance of $1,223.35. He estimates the cost of the department, lights, labor, etc., for the coming year at $29,000, and asks that his salary be increased to $350.

The Webster Electric Light Company has the construction of its plant now well under way. The Jarvis Engineering Company, of Boston, will furnish the necessary steam outfit, which will include the erection of a brick stack 80 feet high. The poles for the street lights have been placed in position, and wiring has been begun. The Company also controls the gas works supplying the town, and they promise to supply a good quality of gas at the price at present prevailing, with an intimation that in the near future the rate will be reduced.

The Amherst Gas Company has decided to undertake the supply of electric lights.

The fact that for several months Anton and Henry Huelsman, owners of a shoe store at 1614 South Broadway, St. Louis, Mo., maintained a gas illumination at their place somewhat superior to that of adjoining stores, while the meter in the cellar showed the passage of a much smaller quantity of gas than was being paid for by their neighbors, led Inspector R. D. Walsh, of the St. Louis Gas Light Company, to institute an investigation. It had been the custom of the meter taker to visit the premises in the discharge of his duties between the 25th of one month and the 1st of the next, and the meter and fixtures had always been found in proper place; but Inspector Walsh correctly surmised that a solution of the matter might be arrived at if he paid his respects to the establishment at a different time in the month. Accordingly, in company with a police officer and without the knowledge of the proprietors of the store, he entered the cellar on the 11th ult., when the mystery of the meager gas consumption was made clear by the discovery of the meter standing idle in a corner on the floor, while in its place had been substituted a rubber pipe through which the gas might flow and supply the house without the intervention of the Gas Company's automatic guardian. Warrants were promptly secured for the arrest of the brothers Anton and Henry, who probably realize that their misapplied ingenuity is likely to cost them dearly.

The City Council of Alexandria, Va., will soon be called upon to determine the question of the acceptance or rejection of the system of oil gas making, which the owners of the process have been experimenting with at the city's gas works for some months past. It had been guaranteed that a better and cheaper article would be produced than the coal gas formerly made; but the Superintendent of the city works does not think the experiments so far made have by any means demonstrated this.

Supplies for Philadelphia Gas Trust.—Director Wagner, on Thursday, Dec. 27th, awarded contracts for the following supplies for the gas works at Philadelphia. *Contracts for Coal:—*

	Tons.	Price per Ton.
Manor Gas Coal Company	5,000	$3.81
Penn Gas Coal Company	57,720	3.82
Westmoreland Coal Company	57,720	3.82
Newburgh Orrel Coal and Coke Company	15,000	3.76
James Boyce	15,000	3.76
Despard Coal Company	10,000	3.76
J. & W. Wood	10,000	3.76
Chesapeake & Ohio (C. B. Orcott)	25,000	3.80
Total	195,440	

The amount called for was 210,000 tons. All bidders received a part of the contract, and to the full extent of their bid, except the Westmoreland and Penn Companies. The prices paid for 1888 were $3.79, $3.83 and $3.84. The specifications of the Bureau of Gas called for 6,000 tons of cannel coal. There were six bidders, but contracts will not be awarded until the samples of coal are tested. *Contracts for Meters.*—The meter manufacturers having sent in bids the same as last year, it was decided to divide the work equally among the four bidders as follows: Goodwin Gas Stove and Meter Company, Helme & McIlhenny, American Meter Company, and Harris, Griffin & Company. *Iron Pipe and Lamp Posts.*—To the Camden Iron Works was awarded the contract for 2, 4 and 6-inch pipe; to the Donaldson Iron Company, for 3 and 8-inch pipe; to the Mellert Foundry and Machine Company, for 12-inch pipe and the lamp posts; and to the Gloucester Iron Works for 20-inch pipe.

THE following special rates for specified terms are made by the West Chester (N. Y.) Gas Company:

10,000	cu. ft.	or	over	per	annum.....	$1.80	per	thousand.
20,000	"	"	"	"	.....	1.70	"	"
50,000	"	"	"	"	.....	1.60	"	"
100,000	"	"	"	"	.....	1.50	"	"

The Company guarantees a gas of 18.5-candle power.

Some time ago Mr. Geo. S. Jervis, a farmer in the vicinity of the village of Newtown, N. Y., discovered in the boggy bottom of a gully running through his farm what he believed to be indications of the presence of large quantities of natural gas. He observed that when a stick was thrust into the muddy bottom of the small brook in the gully and then withdrawn it would be followed by a considerable stream of bubbles, and these bubbles he afterward found to be inflated with gas which he says is similar to that found in Pennsylvania. In 1860 bituminous coal was discovered on the Andrews property, about a half mile southeast from where the gas was first discovered on Mr. Jervis' farm. A shaft about 45 feet deep was put down, but the operators then struck flint rock, which made the mining difficult and expensive, and the work was abandoned. Iron ore was found on Van Dine's Hill, about a mile and a half southeast from Jervis' farm, in 1850. After digging down about 50 or 60 feet this working was also abandoned. Mr. Jervis and his friends insist that the gas found by them is the same as that which is found in Pennsylvania, and points to the nearness of iron and coal to substantiate their assertion. "The Newtown Natural Gas Company" has been formed, with Geo. S. Jervis as President, James P. Rapelye Secretary, and John Hegg, Treasurer. They propose to try and locate the main source of the gas. There is no question but that vegetable decay will amply account for all the gas being found. Newtown is about 7 miles from New York city.

Correspondence

(The JOURNAL is not responsible for the opinions expressed by correspondents.)

Mr. Rew Speaks for His Patent.

2619 PRAIRIE AVENUE, CHICAGO, Dec. 28, 1888.

To the Editor AMERICAN GAS LIGHT JOURNAL:

An article by Frederic Egner, published in the Dec. 17th number of the GAS LIGHT JOURNAL, gives a wrong impression of the value of an exhausting device covered by patent 389,103, granted me Sept. 4, 1888, as he offers to sell a patent for an exhausting device for "one cent and Patent Office charges." Mr. Egner's exhausting steam pipe drains the primary products of combustion from a generator or "producer" and discharges them into a retort; while my exhauster steam pipe, "or any other equivalent device," draws the final burned products of combustion from a heated regenerator and discharges them into the open air. There is no similarity whatever between the two combinations, and no retorts are used in my system of gas making. Patent 389,106 shows my perfected apparatus. In these drawings a stack is used as an "equivalent device," to exhaust the final burned products generated while heating up the apparatus previous to making gas.

In constructing and using this apparatus every element of the claims in patent 389,103 will be put to practical use.

Mr. Egner is correct in saying that "this feature is of more value than a casual observer might think." In fact it is impossible to heat a regenerative chamber economically by forcing through the products of combustion. The burned gas must be instantly drawn away from the gas that is burning in order to produce perfect combustion of all the gases inside of the apparatus while heating up.

Yours truly, HENRY C. REW.

"W. M." Defends Himself.

NEW YORK, Dec. 29, 1888.

To the Editor AMERICAN GAS LIGHT JOURNAL:

DEAR SIR:—Your correspondent "W" suggests that I am interested in some patent self-sealing lid, which is a great mistake on his part. I am not interested in the manufacture or sale of any lid whatever. He then says that I could not have written the article in question from my own experience. But what prevents anyone from collecting the experience of others and quoting their experience? Must a writer on any subject write from his own experience only? I contend that a general observer and outside collector of facts is more sure to be right than the person who sees only what is going on in his own narrow field of operations. Who is better able to write an account of a battle than the correspondent who from some "coign of vantage" surveys the whole field, or the private soldier who is in the thickest of the fight? I have heard a gas engineer state, while talking on this subject, "that if self sealing lids were more imperfect than they are he would not return to luted lids" It seems to me that the one convenience of having the lids hinged to the mouthpiece would compensate for many imperfections.

As to the "constant attention and expense required to clean and repair these lids," it would seem that the continual cleaning and luting at every charge was a very large item on the other side. While I admit that perfect lids have not yet been made, still, if the great majority of coal gas works do not use self-sealing lids and find them better than luted lids, I am greatly mistaken, and will acknowledge it when proved. W. M.

The Story of the September Floods at Augusta, Ga.

THE GAS LIGHT COMPANY OF AUGUSTA, GA.,
AUGUSTA, GA., Dec. 19, 1888.

To the Editor AMERICAN GAS LIGHT JOURNAL:

In compliance with your request for details regarding our trials and tribulations from the flood of last September, I have to say that it took place just before my arrival home from my trip North. Returning, I found myself detained at the Congaree River Bridge. On account of damage to it we were carried over that bridge on hand cars and pushed on to Augusta, or rather to the side of the river opposite the city. We were obliged to remain in the cars because the bridge at this point was impassable, being covered by fallen trees and debris of every sort and character which had accumulated there from the work of the freshet. Finally, however, we succeeded in being ferried to our home, when I found that my sons had been compelled to take the furniture, carpets, etc., to the second floor—the water having reached within a few inches of the first floor, although the house is located on a high level of the city.

As soon as possible I started out on a tour of examination. Reaching the works, I found them entirely surrounded by water and the tanks completely submerged. The outlet pipes forming a ready means for the water to pass down, and the main pipes throughout the city were filled. The retort house fires were completely extinguished, there being nearly two feet of water in the retort house; of course, the condenser rooms and office floors were all submerged. This being the condition of the works on my arrival—with 30 miles of mains, the services and a large number of meters filled with water, in many places the pipes were broken—you may judge that the prospect for starting up the plant in order to supply the city with gas was not very brilliant. However, with the assistance of my sons and the help of a corps of assistants, we were enabled to fire up the works—the water receded very rapidly—and to pump out the mains, so that on the third day after the flood had disappeared from the streets we commenced to supply gas to the consumers nearest the works, and within a week we were supplying gas to the city. I question if any other gas works in the United States that met with such a disaster, by which the whole city was submerged, and mains, services and meters filled with water, and every fire extinguished, would within a week be supplying gas to its consumers.

Of course, this disaster entails a loss of many thousands of dollars to the Company, and the loss is into the millions, so far as the destruction to the property of our citizens is concerned. At many points the cuts made in our streets by the resistless rush of the floods required from 500 to 1,000 cartloads of earth to restore them to their proper levels. In fact nearly all the streets of our city were practically destroyed. All over the city can be seen laborers leveling off the loads of earth dumped before them in an endeavor to put our city in a presentable shape once more. Now our thoroughfares are beginning to present their former good appearance, and the stranger who visits us would scarcely dream that but a few months ago we were visited by such a disastrous and destructive flood. With best wishes I remain,

Very truly yours, GEO. S. HOOKEY.

Not in Accord with General Hickenlooper.

POUGHKEEPSIE, N. Y., Dec. 20, 1888.

To the Editor AMERICAN GAS LIGHT JOURNAL:

In your issue of December 17, you published Gen. Hickenlooper's remarks on the use of gas as fuel. I desire to state some facts which must necessarily be in direct opposition to some of his statements. He asserts that "the most thorough scientific research has established the fact that the comparative number of pounds of water which an equal volume of each will evaporate within a given time is as follows: Illuminating coal gas, 18.80; uncarbureted water gas, 7.60; generator or fuel gas, 2.90. That is, our Cincinnati gas possesses 2.48 times the number of heat units that the *very best* uncarbureted water gas does, and 6½ times the number contained in generator or fuel gas."

I must say that he speaks unadvisedly and evidently without even knowing how water gas is usually made. What he calls "generator or fuel gas" is probably the same which Mr. McMillin refers to as "producer gas" in his paper read before the American Gas Light Association; but "producer gas," as generally understood, and water gas differ greatly in their component parts, while "water gas" and "generator or fuel gas" are different names for the same gas.

Water gas is generated by the decomposition of the vapor of water in the presence of incandescent carbon, and is composed of hydrogen and carbonic oxide in equal volumes—that is, hydrogen 50 per cent. by volume, and 6 per cent. by weight, and carbonic oxide 50 per cent. by volume, and 94 per cent. by weight. When carbureted it is called "illuminating gas," and when uncarbureted it is called "water or fuel gas." There is no need of trying to mix matters, or to talk of different gases, some of which contain a large percentage of hot air or nitrogen, or both.

Coal gas men differ greatly in their statements in relation to water gas as to its specific gravity, units of heat, cost of manufacture, commercial value, etc., as compared with coal gas. I will endeavor to state facts obtained from most thorough scientific research, and long practical experience in the manufacture of water gas.

There are two systems for the manufacture of water gas. In the report of the special committee of the Franklin Institute at the Novelties Exhibition in Philadelphia, 1885, the manufacturers of water gas were divided into two classes, viz:—1, the system of external firing; 2, the system of internal firing; and the report states: "Passing by numerous patented processes embraced in this division of the subject, the Allen-Harris process appears to have reached its highest state of development in the United States Patents (No. 112,593) * * * and (No. 129,951) * * * The first of these is for fireclay, horizontal double retorts, for the production of water gas by the delivery of superheated steam in finely-divided jets through incandescent carbon. The second * * * describes a gas generator of vertical fireclay retorts for the production of water gas by the * * * same process. This arrangement of apparatus seems to be a very effective form, and may stand as a typical representation of the class of water gas systems here considered."

Prof. C. F. Chandler, of Columbia College, an expert in chemical, sanitary and gas matters, personally examined our gas works in December, 1885, and certified "that the Citizens Gas Company, of Poughkeepsie, manufacture gas by one of the best processes known. * * * The process is known as the Allen-Harris process, and involves the application of continuous, high, external heats. * * * The generators are not opened every few minutes, as in some other processes, but are closed for long periods, and this process results in the production of the smallest amount of refuse of any process in use in gas making."

Now this is the pure and "best water gas," containing no nitrogen, hot air, or carbonic acid, to which I refer in disproving the statements made by Gen. Hickenlooper that "our Cincinnati gas possesses 2.48 times the number of heat units that the very best uncarbureted water gas does."

Mr. McMillin, who appears to have given the subject of heat units in the different gases a good deal of consideration, is reported to have said, during the discussion of the paper read by him, before referred to, that the theoretical values which he produced "are obtained from experiments in the first place; and any experiments that I have ever known to be made have usually verified those as closely as it would be possible for *crude* apparatus to do;" and he might have added that the results of these crude experiments, made by crude experimenters, with crude apparatus, were nothing but theoretical fancy work, in which coal gas was always made to come out first-best. But I believe after "the most thorough scientific research" that the following statements cannot be controverted:

I. Comparisons of the calorific intensities of the different gases, made by different scientific gas chemists, with *approved* apparatus, show *different* results under *different* circumstances; that is, the calorific effects in heating liquid water in equal volume of the gases burning in air, are as follows: Hydrogen, 5788° F; Carbonic Oxide, 5425° F; Marsh Gas, 4820° F; Olefiant Gas, 5481° F. While their calorific intensities in free flame are as follows: Hydrogen, 4980° F; Carbonic Oxide, 5425° F; Marsh Gas, 1277° F; Olefiant Gas, 1001° F.

II. Some of the most eminent gas chemists say that we have no certain data as to the real nature of the illuminant hydro-carbon vapor present, and no experimental calorific equivalents in such a computation.

III. The comparative power of these gases in heating equal weights of water to equal temperatures below 1000° C., and above 100° C., by equal volumes, differs considerably, viz:—

	Below 100° C.	Above 100° C.
Water gas uncarbureted	3,100°	2,757°
Water gas carbureted	2,959°	1,861°
Ordinary coal gas	2,974°	1,627°

IV. "The most thorough scientific research" shows that the hottest flame producable under ordinary atmospheric conditions is that of carbonic oxide, and that for all modes of application the total maximum calorific effectiveness of carbonic oxide is the same when burning in air and in free flame. This is an important point and worthy of note.

V. The late Prof. Silliman, of Yale College, said that carbonic oxide, when freed from carbonic acid, is not inferior in calorific availability, even within ordinary temperatures, to its own volume of rich illuminating gas from bituminous coals; but for temperatures above ebulition of water, such water gas may surpass in total calorific effect such coal gas, as much as 70 per cent.

VI. Prof. Bunsen, the acknowledged expert chemist, and standard authority upon gas matters, has with other gas chemists demonstrated by many experiments that carbonic oxide, which heretofore has been considered a non-luminant, the same as hydrogen and marsh gas, may under certain circumstances, produce intense luminosity, without the presence of any carbon. Devills' theory is that the increased luminosity of flames is due *solely* to the increase in temperature.

It would appear from the above that the practical possibilities of carbonic oxide are not generally understood, and statements based upon experiments made with "crude apparatus" by unknown persons, are entirely out of place in any scientific point of view.

VII. Hydrogen, carbonic oxide, and marsh gas or light carbureted hydrogen, are permanent gases, and produce combustion. Oxygen aids combustion. Carbon is a mineral, and if decomposed, as a great portion usually is, during the process of manufacture under the old coal gas process, it loses its power of reflection, and gives no more light than hydrogen or marsh gas.

VIII. Hydrogen and carbonic oxide, which produce the highest calorific intensity of any of the gases, form "water gas." Hydrogen and marsh gas form the basis or substratum of coal gas. Carbonic oxide, as shown above is a constant quantity, whether burning in air or free flame, and of great value in illuminating, as well as fuel gas.

IX. Dr. M. Ozanam, a famous authority on the the properties and nature of gases, says under the head of "action of carbonic oxide on man": "Can carbonic oxide be inhaled by man? Everything points to the belief that it can. . . . The twenty-five experiments which we made, and of which several have been repeated upon the same animals, show that the use of this gas *is not as dangerous* as was formerly believed, since we have but one case of death among animals so delicate as rabbits." Mr. G. Tourdes, another famous authority, in an article upon the anæsthetic action of carbonic oxide, says that "the two fundamental facts are the harmlessness of the gas, and its anæsthetic action."

I believe that the above statements, and the mention of the different combinations of the gases, without further remark, show that Gen. Hickenlooper's sweeping assertions, as to the superiority of coal gas as now made, either for light or fuel, are unfounded.

X. I agree with him that gas will be the fuel of the future, but not coal gas as now made at Cincinnati. When coal gas is made in connection with water gas, and a chemical combination is formed *during the process of manufacture*, as shown by the late "Improved Allen-Harris Process," by which the enigma of the presence of naphthaline will be solved; the formation of incrustations in the retorts, and the frequent and troublesome stoppages in the stand pipes will be removed; the present wasteful system of carbonizing coals will be superseded, by furnishing a full supply of the permanent gases to absorb, protect, carry off, and utilize the carbons at the moment when they become volatilized (and not allowing them to become deposited, or to form objectionable combinations), and thereby obtaining at least 20,000 or 25,000 cubic feet per ton of coal out of a possible 50,000 cubic feet of higher candle power and specific gravity, and in every way a better gas at greatly reduced cost, instead of the present highest average of 11,000 or 12,000 cubic feet of low candle power and light specific gravity. Then coal gas men may expect increased profits from lower prices by an increased consumption of gas, which has already become a great necessity, and marks the outward progress of civilization through the world.

H. L. ALLEN.

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MONDAY, JAN. 7, 1889.

Odd Lots.

HOLIDAY GAS CONSUMPTION, PHILA., PA.—The following is from the Philadelphia *Record*: "The city gas works were run at their full capacity during the past week to supply the great Christmas demand for light. The consumption was unprecedented, and no holiday week of former years required such laborious work and long hours from the gas officials. All the extra men were kept busy, and every bench was used. On Monday 14,454,000 cubic feet of gas were consumed, against 13,415,000 feet in 1887, or 1,039,000 ft. more. On Christmas day 10,784,000 feet were used. A comparison of the three days in the two years shows:

	1887.	1888.
Day before Christmas..	13,415,000	14,454,000
Christmas.....	9,479,000	10,784,000
Day after.....	11,075,000	12,933,000

It is thought that the week just passed will show nearly 4,500,000 cubic feet ahead of the same period last year in the consumption of gas."

NOT ALTOGETHER "SOULLESS."—The Newton (Mass.) *Graphic* has the following: "The truth of the statement made last week that the Gas Company was prepared to treat the city fairly was shown by the action of the Company in regard to making a temporary arrangement about prices. The Street Light Committee have carried out Ald. Johnson's order, and asked the Gas Company to make some reduction from the present prices until the new city government shall make a contract. The Committee and the officers of the Company held a conference this week, and the latter offered to make a 10 per cent. reduction all round on electric lights, gas lamps and oil lamps. This seemed perfectly fair to the Street Light Committee, and was accepted. The new arrangement is to continue until the new city government agrees in regard to a yearly contract. The Gas Company is a monopoly, and it is always popular to rail at monopolies; but in this case the officers and stockholders comprise many of the leading citizens of Newton, and if they always show such an accommodating spirit the city will have no cause to complain. Alderman Johnson is entitled to the credit for the reduction, as it was at his suggestion that the attempt to secure it was made, and the Gas Company could hardly be expected to make any reduction until it was asked to do so. Now, if the Committee will use the money thus saved in having the streets lighted on dark and stormy nights when the moon fails to connect, the citizens will have good reason to be satisfied."

SOME FACTS CONCERNING THE EXETER (N. H.) GAS LIGHT COMPANY.—The Portsmouth *Times* says: "The gas manufactured at the Exeter works is of 18.5 candle power, and there is just double the quantity consumed now that there was in 1883. The price has been reduced during the past five years from $3.76 to $2.80 per thousand feet. During that time 4,580 feet of main pipes have been laid, and the number of street lights has been increased from 38 to 72. Service pipes and meters are not charged for, as is the rule in most other places. The Company was organized Dec. 23, 1861, with a capital stock of $52,250, which in 1887 was reduced to $40,000. The par value of the stock of this Company is $50 per share, on which an annual dividend of 6 per cent. is regularly paid. The stock is scarce, and cannot be purchased even at a handsome premium."

AN ELECTRIC METER.—The following appears in the Boston (Mass.) *Globe*: "The Thomson-Houston Electric Company, of Boston, has sent to Troy, N. Y., a new invention in the shape of an electric meter. It is intended to measure, as gas is measured, the quantity of electricity used by those who have the light Experiments are in progress, and, if the meter does the work expected of it, it will probably be placed in every building in Troy where the light is used. The present system of use as you please on the payment of a certain amount necessarily compels some persons to pay for more light than thay require, while others pay for a great deal less than they have."

LIGHTING HOOSAC TUNNEL BY ELECTRICITY.—The following is from the Springfield (Mass.) *Republican* of Dec. 31: "The work of putting the electric light plant in the Hoosac Tunnel has been completed, and the system was started on a 30-days' test Thursday morning, after which, if successful, it will be turned over to the Fitchburg R.R. Company. The building at the west portal contains two 125-horse power boilers, and a 125-horse power engine. Here, also, are three Westinghouse dynamos, each having a capacity of 650 lights, and two direct current machines. There are 1,250 lamps in the tunnel, arranged in sections of twenty 50-volt lamps in a section, so that should a break occur that section may be shut off. The lights are placed 40 feet apart on either side of the tunnel, making a light every 20 feet. At each manhole, which are 250 feet apart, is a blue light to denote the location of the manholes, which are places of refuge from trains for men working in the tunnel. Over 40 miles of lead-covered wire was used in the system, all of it being laid in wooden conduits along the sides of the tunnel. The work of putting in the system has taken nearly a year, and considering the great disadvantages under which the work was done, it was accomplished in a remarkably short time. The tunnel is now well lighted, and a trip through it is very interesting.

ASPHALTINE.—According to J. A. Le Bel the black coloring matter of bitumens and natural petroleums has received the name asphaltine. Some samples of this product contain iron, lime and sulphur. Markownikow and Oglobine found in the ash of the petroleum of Baku calcium, iron, alumina, copper, and traces of silver. Some samples contain as much as 10 per cent. of sulphur. He finds in the ash of asphaltine 13 per cent. of silica, 17 iron oxide, with traces of manganese, the rest consisting chiefly of lime and calcium sulphate. The interesting feature is the presence of silica, which cannot have been dissolved in the petroleum, and which affords an argument in favor of Mendeleef's theory of the organic origin of mineral oils.

The Market for Gas Securities.

About the only change to be noted in the gas share market has been the resumption of the inevitable upward movement of N. Y. Consolidated, the same being now 82 bid. Chicago Gas Trust has also moved 3 points upward. Reports are circulating to the effect that Mr. Addicks has secured the necessary $12,000,000 of foreign capital for the purchase of the stock of the Boston Gas Company.

We note the following dividend declarations: Providence (R. I.) Gas Co., $1 per share; Hartford (Conn.) Gas Co., semi-annual dividend of 4 per cent.; Burlington (Vt.) Gas Co., semi-annual dividend of 4 per cent.; North Attleboro' (Mass.) Gas Co., 3 per cent.; Citizens Gas Co., of Brooklyn, paid, on Jan. 2, a dividend of 2½ per cent., being an increase of ½ per cent., making 4½ per cent. for the year.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.

16 WALL ST., NEW YORK CITY.

JANUARY 7.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated.....	$35,430,000	100	82	—
Central.....	440,000	50	—	60
" Scrip.....	220,000	—	47	57
Equitable.....	4,000,000	100	—	116
" Bonds.....	1,000,000	—	113	115
Harlem, Bonds.....	170,000	—	—	—
Metropolitan, Bonds....	658,000	—	115	118
Mutual.....	3,500,000	100	97	98
" Bonds.....	1,500,000	1000	100	102
Municipal, Bonds.....	750,000		—	—
Northern.....	125,000	50	30	—
" Scrip.....	108,000			
Yonkers.....		50	90	100
Richmond Co., S. I....	300,000	50	55	60
" Bonds.....	12,000			

Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	103	105
Citizens	1,200,000	20	52	54x
" S. F. Bonds	320,000	1000	—	103
Fulton Municipal	3,000,000	100	130	133
" Bonds	300,000		—	106
Peoples	1,000,000	10	74	75
" Bonds (5's)	368,000	—	97	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	87	90
Nassau	1,000,000	25	110	—
" Ctfs	700,000	1000	100	103
Williamsburgh	1,000,000	50	124	125
" Bonds	1,000,000	—	111	112
Out of Town Gas Companies.				
Boston (Mass.) Gas Co	2,500,000	500	200	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	—	—
" " Bonds.	45,000	—	—	—
Chicago Gas Trust	25,000,000	100	37⅜	—
Cincinnati G. & C. Co.	6,000,000	100	187½	188¾
Consumers Toronto	1,000,000	50	192	—
Central, S. F., Cal.			—	90
Capital, Sacramento, Cal.			58	—
Consolidated, Balt.	11,000,000	100	48½	49
" Bonds	6,400,000		107	107½
Hartford, Conn.	750,000	25	—	138
Jersey City	750,000	20	165	170
Laclede, St. Louis, Mo.	2,000,000	100	—	115
Louisville, Ky.	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	207	—
Memphis (Tenn.) Gas	750,000	100	48	51
" Bonds.	240,000	100	103	—
New Haven, Conn.		25	193	197
Oakland, Cal.			33	33½
Peoples, Jersey City		—	60	61
" " Bonds.			—	—
Paterson, N. J.		25	90	—
Rochester, N. Y.		50	75	80
Syracuse, N. Y.	500,000	25	—	—
St. Louis, Missouri	600,000	50	—	—
San Francisco Gas Co.				
San Francisco, Cal.	10,000,000	100	59¼	59¾
Washington, D. C.	2,000,000	20	200	201
Wilmington, Del.		50	200	208

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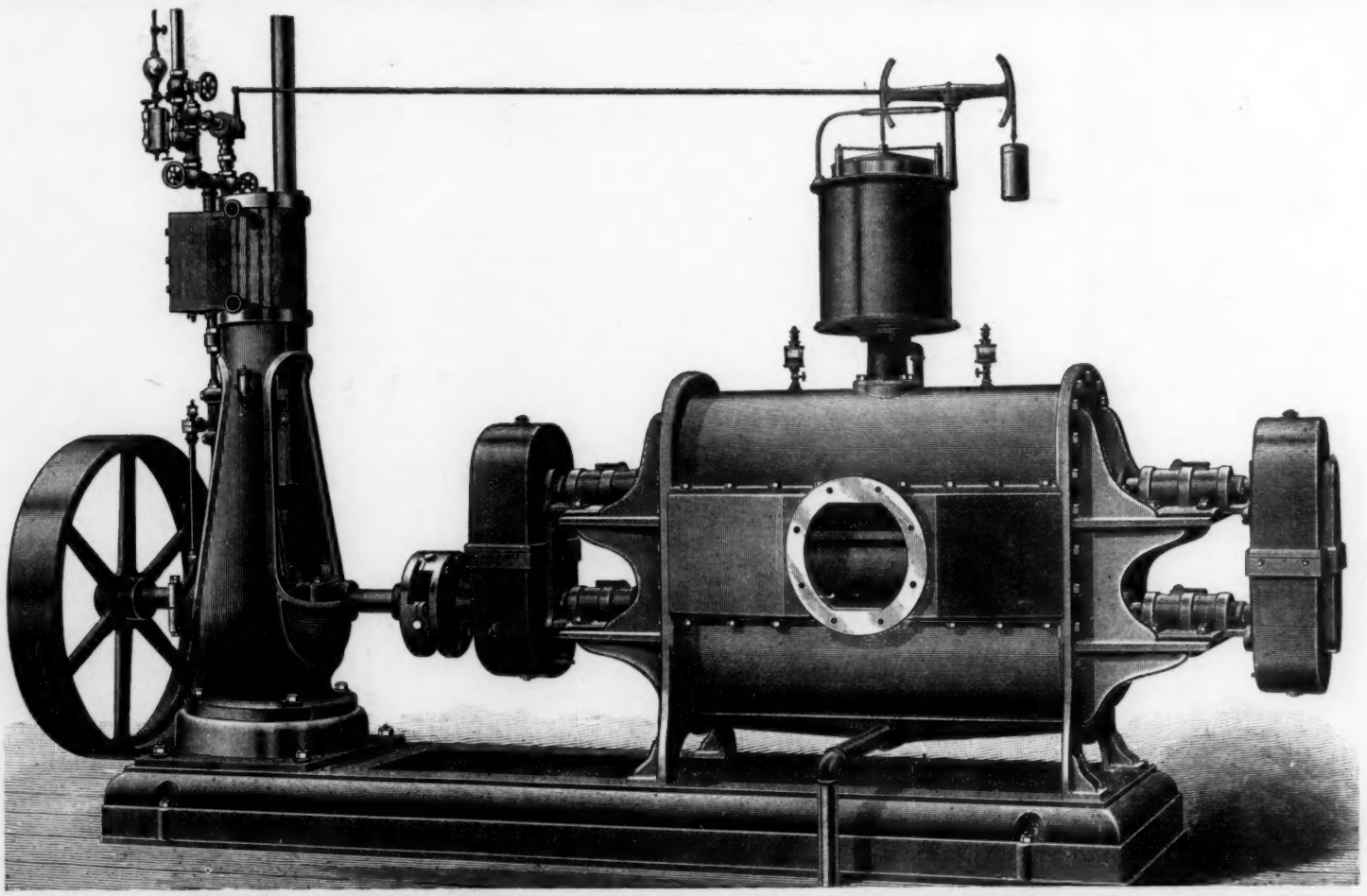

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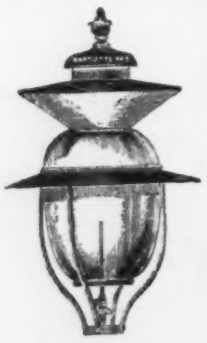

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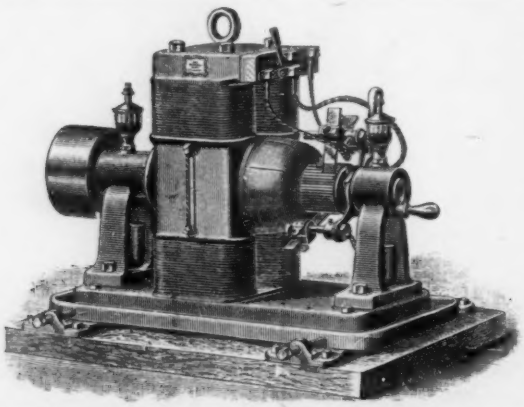

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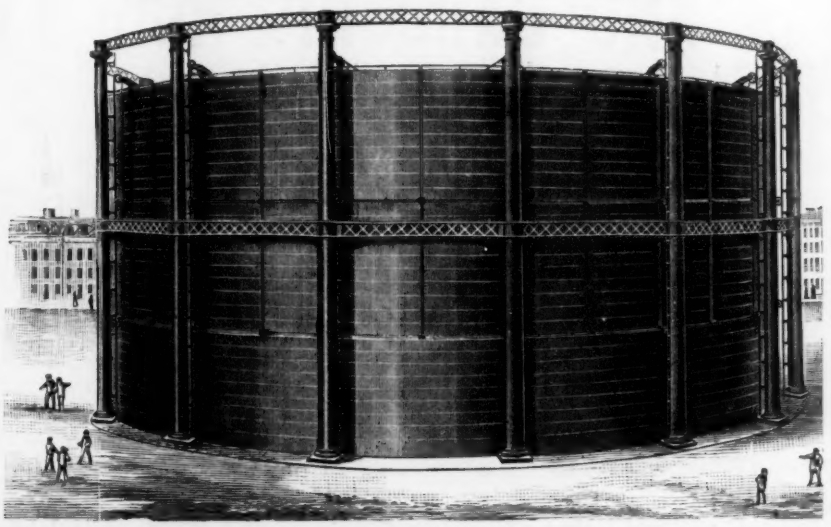

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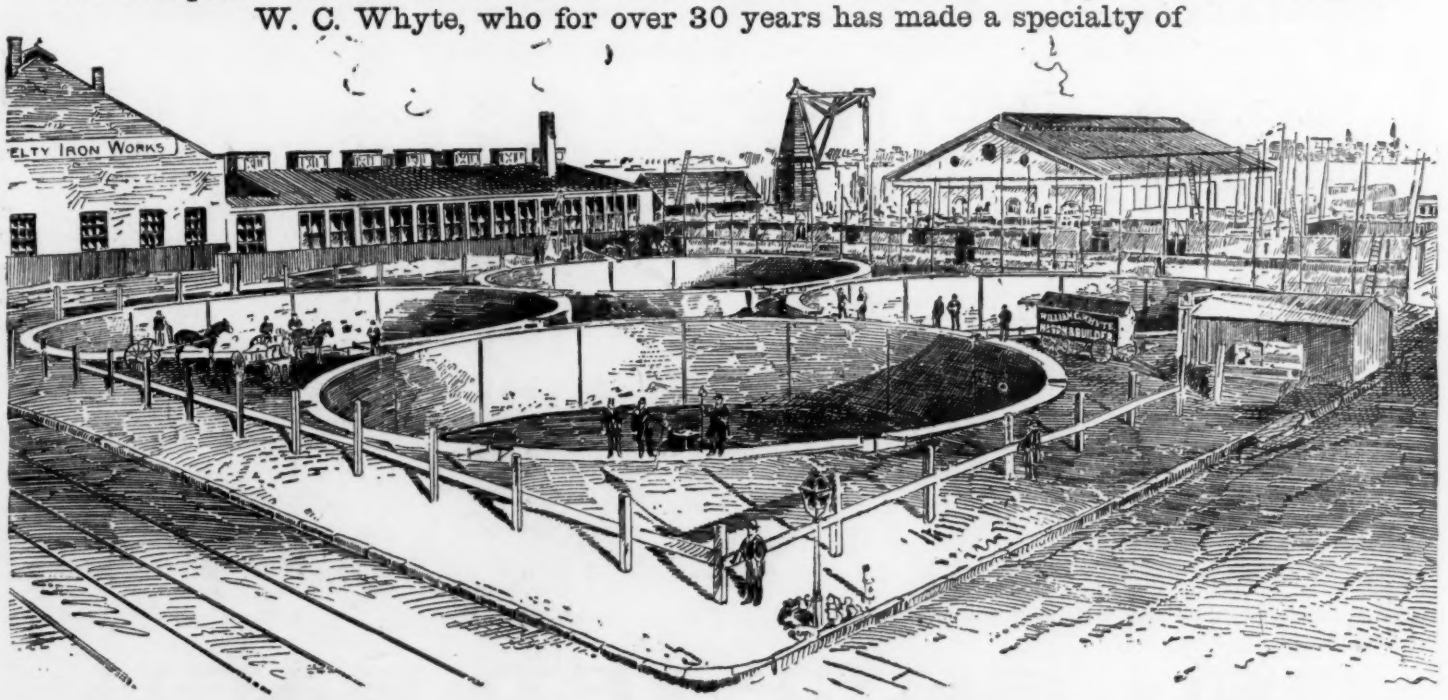

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A very general demand exists, in both large and small Gas Works, for an apparatus that will be absolutely efficient in the removal of the tar which passes the hydraulic main and condenser. Many attempts have been made to accomplish this, but, I believe, without success, until the introduction, five years ago, in England, of the C. & W. Walker Patent Tar and Carbonic Acid Extractor. During these years this apparatus has been adopted by many of the most prominent Engineers, not only in England, but also on the Continent of Europe and in other parts of the world. It is only necessary to give here a partial list in order to convince any intelligent American Gas Engineer that this machine must have succeeded fully in accomplishing the desired results.

The following Engineers have personally given permission to refer to them:

G. C. Trewby, Esq., Engineer-in-Chief of the Gas Light and Coke Co., London. The manufacturing plant at Beckton is built in complete sections of 3,000,000 cubic feet capacity each. A Walker Tar Extractor has been fi ted to each one of these sections. This was done after a long and thorough trial on one of its sections. The Tar Extractor has been supplied to other works of the Gas Light and Coke Co., including those of which John Methven, Engineer of the Gas Light and Coke Co. at the Nine Elms Station, is in charge. Also to G. E. Stevenson, Peterborough Gas Works; B. Green, Mitcham and Wimbledon Gas Works; W. H. Smith, Bedford Gas Works; F. Linging, Norwich Gas Works; J. T. Browning, Colchester Gas Works; S. B. Darwin, Portsmouth Gas Works; J. McCrae, Dundee Gas Works; W. J. Wells, Stamford Gas Works; J. M. Darwin, Longton Gas Works; J. Paterson, Warrington Gas Works; and J. Coulter, of the Dundalk Gas Works. All of the foregoing gas works are located in Great Britain.

Mr. Charles A. Gerdenier, Superintendent of the Bridgeport (Conn.) Gas Light Company, writes as follows, under date of Dec. 3, 1887:

"The C. & W. Walker Tar and Carbonic Acid Extractor has been in operation at these works for the past six weeks, and is an unqualified success. It removes every particle of Tar from the gas in once passing through the apparatus and a large percentage of the Carbonic Acid. I also feel quite sure that it prevents the formation and deposit of Naphthaline, because since I started the Washer I have had no stoppages from this cause. These works have been seriously troubled with Tar for many years, and I have used several kinds of apparatus and every expedient which has come to my attention for dealing with the difficulty, but without success. The Walker apparatus occupies comparatively small space, is less expensive than other systems, and requires but little attention. I carry 2½-inch seal, and have an automatic tar delivery valve. This Tar Extractor is indispensable to gas makers."

I have taken the Agency for the United States for this apparatus, and am now prepared to make contracts to erect it on the premises of any Gas Company. It would be manufactured in the following sizes:

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No. 3,	"	"	250,000	"	"	"	5	"	"	"	"
No. 4,	"	"	500,000	"	"	"	6	"	"	"	"
No. 5,	"	"	750,000	"	"	"	7	"	"	"	"
No. 6,	"	"	1,000,000	"	"	"	8	"	"	"	"
No. 7,	"	"	1,250,000	"	"	"	9	"	"	"	"
No. 8,	"	"	1,500,000	"	"	"	10	"	"	"	"
No. 9,	"	"	2,000,000	"	"	"	12	"	"	"	"
No. 10,	"	"	3,000,000	"	"	"	15	"	"	"	"

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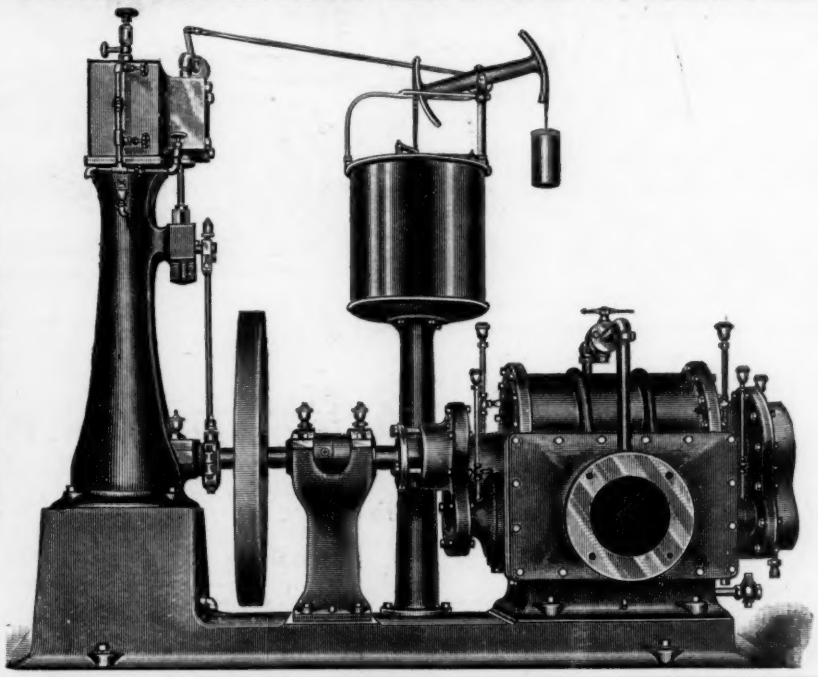

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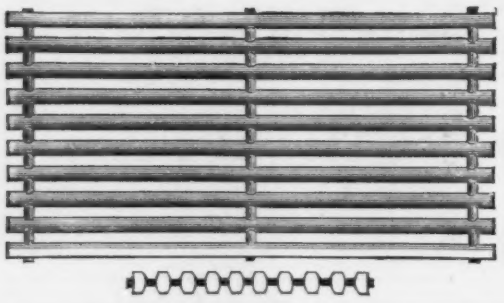

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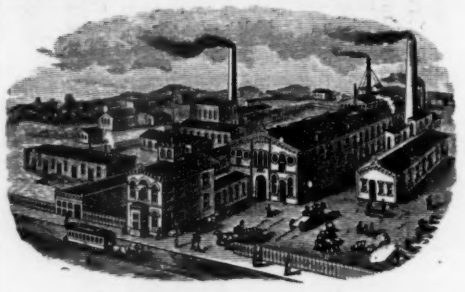

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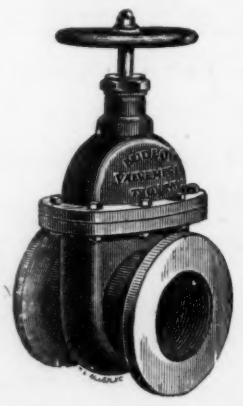

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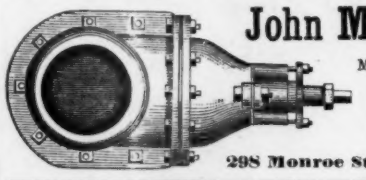

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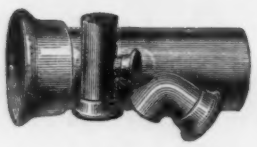

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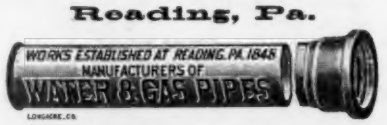

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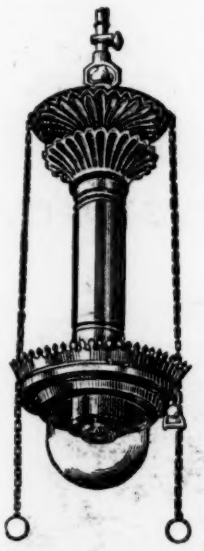

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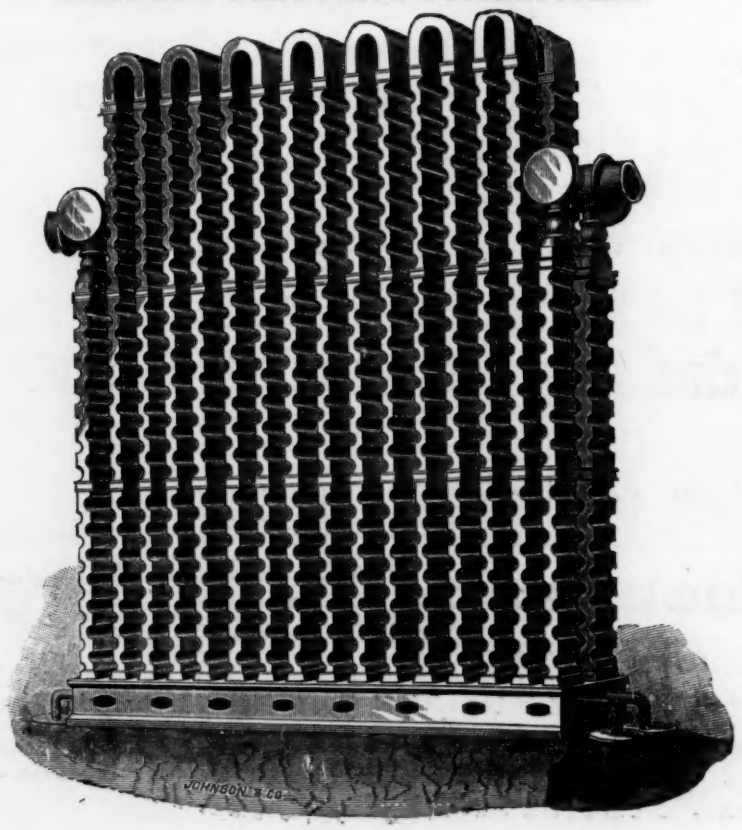

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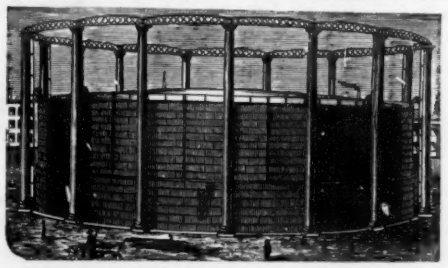

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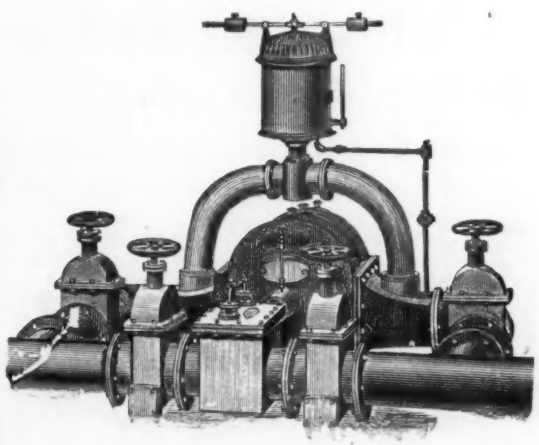

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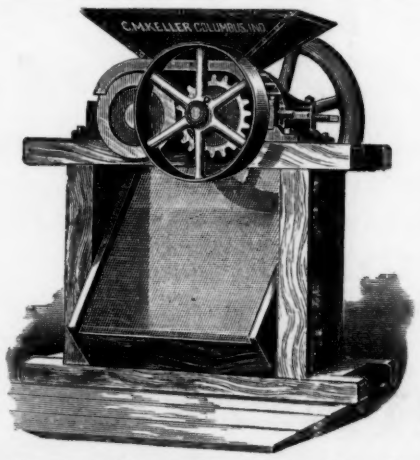

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We use only the very best materials, and employ the most skilled labor, and by our long experience (32 years) and personal supervision of every detail, we feel justified in assuring the public that our goods will give perfect satisfaction. Every Meter emanating from our establishment will bear the State Inspector's Badge, and will be fully warranted by us. Our Annual and Calendar will be sent to Gas Companies upon application.

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SOLE MANUFACTURERS OF THE

"SUN DIAL" GAS STOVES,

The Most Economical, Efficient, and Durable Gas Stove Made.

GAS COOKING STOVE, No. 8 C.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
37 in. high.	12 in. high.	12 in. high.	24 in. long.	36 in.
20 in. wide.	17½ in. wide.	18 in. wide.	21 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crosspieces and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

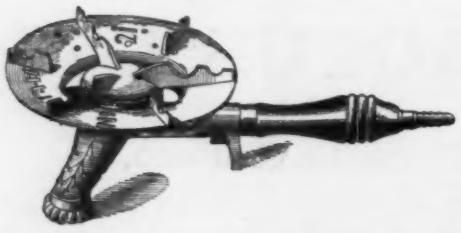
Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
31 in. high.	9½ in. high.	10 in. high.	21 in. long.	32 in.
17 in. wide.	14½ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

This cut represents our New Style Cooking Stove. As will be seen, it has an ornamented cast-iron Base and Front, and extension shelves. The Oven Burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent). The ovens are of greater capacity than those of the old style. The Top, in conjunction with the Outlet Pipe, is designed to carry off all the products of combustion, if desired, but they are also supplied with a loose ring which converts it into an ordinary open top stove.

The consumption of this Stove is 35 cubic feet per hour at 1 inch pressure, with all Burners in use.

All Fittings are Nickel-Plated.



"RADIANT" BOILING STOVE, WITH REGENERATIVE BURNER.

Size, 6¼ inches diameter, 8 inches high. Consumption, 6 feet per hour at 1 in. pressure.

HOT PLATE, No. 111.

Size, 36 in. long, 12 in. wide, with three double burners, 6 taps.

Consumption, with all burners in use, 36 cubic feet per hour, with 1 in. pressure.

¾ in. supply pipe should be used where the pressure is 1 in. or over.